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electronics TODAY INTERNATIONAL

Discover BURIED TREASURE with our 'Induction Balance' METAL LOCATOR

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Very high-power strobe

100W-12V Amplifier

Transistor-assisted Ignition

444 Amp modified

Technics

where leadership has become a tradition

In 1970 Technics introduced the world's first direct-drive turntable. Since then we have developed a range of turntables universally accepted by professional studios and discerning audio buffs alike.

The heart of the original direct-drive turntable was the precise, low-speed DC servo motor with performance characteristics equal to that of fine record-cutting equipment.

In developing phases a competitively priced tone-arm equipped direct-drive unit brought professional features within the reach of the discriminating hi-fi enthusiast. Then fully automatic operation was combined with the direct-drive principle. A major innovation was the quartz phase-locked SP-10 Mark II — a thoroughly professional unit with amazing performance data (w and f within 0.025% WRMS) and separate power supply.

In 1976 new generation technology such as the Back Electromotive Force Frequency Generator improved speed stability under varying loads. One chip 321-element integrated circuitry to drive and control the DC motor was also implemented.

This year Technics offer you the widest choice of direct-drive turntables to complement your Hi-Fi system — a range reflecting not only the continuing advances of audio concepts but also eye-catching design.

Leadership in the past. We think it's an obligation to provide leadership in the future.

Shown above is the souvenir edition Technics SL-1300 fully automatic turntable presented to Haco Distributing Agencies Pty. Ltd., to celebrate the production of the 300,000th Technics direct-drive turntable.

National **Technics** hi-fi

electronics TODAY INTERNATIONAL

A MODERN MAGAZINES PUBLICATION

MAY 1977, Vol. 7. No. 5

Editorial Steve Braidwood
Publisher Collyn Rivers

Electronics Today International is Australian owned and produced. It is published in Australia, Britain and Canada and is the fastest growing electronics magazine in each country.

COVER: Ask George Hofsteters to come up with a cover picture and you don't expect to get a straightforward treatment — 'What do you want to show?' he asked, 'A metal locator' we said!

If you really want to see the metal locator — and this design beats any we've ever seen in any magazine — turn to page 37.

*Recommended retail price only

PROJECTS

FEATURES

NEWS & INFORMATION

Free Inside . . . CB Australia looks at CB Accessories

HP SIGNATURE ANALYSER

A new equipment to aid field troubleshooting to the component level of micro-processor-based products with Hewlett-Packard's new signature analysis service technique. The Model 5004A Signature Analyser locates faulty bit streams in microprocessor-based circuits with an accuracy of 99.998 per cent. Because of complex timing relationships within logic circuitry, conventional service techniques (using oscilloscopes and voltmeters) are not adequate to easily locate faults to the component level.

Consisting of an active probe, connectors to test points within the circuit under test, and the case containing the electronics and display, the 5004A checks operation of microprocessor-based products where data streams are long and complex. It recognises and displays a unique hexadecimal number (signature) associated with each data node in the circuit.

After the service technician connects the 5004A to the product under test, he probes specified test points according to the manufacturer's instructions. Signatures displayed on the 5004A are compared with correct signatures printed on the schematic of the circuit under test. If a wrong signature appears, the technician is guided, with the help of service notes, through the circuit to the faulty component.

However, products must be designed with signature analysis service in mind. The duty-free price of the Hewlett-Packard Model 5004A is $1115.

Cheap 35-step Programmable

Hot news from ETI's teleprinter . . . ETI LONDON . . . STOP PRESS NEWS . . . SINCLAIR HAVE JUST LET LOOSE A 35-STEP PROGRAMMABLE CALCULATOR SELLING FOR 15 POUNDS. IT LOOKS SUPERB, NAY VERY SUPERB. A FULL 294-PROGRAM LIBRARY COSTS ANOTHER 5 POUNDS. SHOULD BE RELEASED IN AUSTRALIA SOON. . . We're following up this story and there should be a full description in next month's ETI.

CHANGES AT ETI

Steve Braidwood, who has so brilliantly edited ETI for the past year is returning to Britain to take up a new career. The publisher would like to thank him for doing such an excellent job and join Steve's many Australian friends in wishing him every success in his new career.

Steve's replacement is Les Bell. Les was originally with ETI's UK edition. He has spent the past few months in Canada where he has been setting up our new Canadian edition.

Like Steve, Les is involved with amateur radio — his call sign is currently GM4CFM but will of course soon be a VK.

LOW-CONSUMPTION OP-AMP

The Philips TDA4250 is a programmable monolithic operational amplifier designed for applications requiring low stand-by power consumption over a wide range of supply voltages – such as found in battery powered equipment. It is available from Philips Electronic Components & Materials.

The quiescent current of the amplifier can be set by a single external resistor or current source. With this programming, the power consumption, input current, slew rate and gain-bandwidth product can be tailored to a particular application. The current consumption can be reduced to a few microamps.

The TDA4250 requires no frequency compensation, is fully protected against short circuits, and operates with a supply voltage from ±1V to ±18V.

DICE FOR AUSTRALIAN TV

Australian TV used DICE (Digital Intercontinental Conversion Equipment) for the first time for a live telecast on March 27th this year (for the Academy Awards presentations from the United States). ATN 7 in Sydney had the equipment installed to convert the American 525-line, 60 fps, picture to our 625-line, 50 fps standard. DICE was developed by the British IBA and is manufactured under agreement by Marconi Communications Systems, Ltd. DICE uses computer techniques to interpolate between the points produced by digitising the American picture — an amazing feat when you consider this is not just a change in the number of lines (the IBA had a convertor for this when Britain changed from 405 to 623 lines) but also a change of field frequency. And then there's the change from NTSC to PAL!

Marconi equipment is installed by AWA.

DIGEST

PIONEER TURNS TO QUARTZ

Pioneer has headed up its new range with a super-precision quartz direct-drive turntable. The heart of the PL-550 is a quartz-PLL controlled high-torque direct-drive motor which brings the turntable platter up to true speed within two thirds of a rotation. Wow and flutter is kept to 0.025 per cent (WRMS) with a signal to noise ratio of more than 70 dB. Recommended retail price is $429.

NEW SIGNETICS OP-AMP

Signetics operational amplifier SE/NE538, now available from Philips Electronic Components and Materials, has a slew rate of typically 60 V/us, with a guaranteed minimum of 40 V/us. Internally compensated for gains of 5 or larger, the SE/NE538 has a gain bandwidth product of 6 MHz and a differential input voltage range of 30 V. The common mode rejection ratio is typically 90 dB. Full protection against short circuits is provided.

PHILIPS' USRT

Signetics new 2652 universal synchronous receiver/transmitter (USRT) is now available from Philips Electronic Components and Materials. It operates on a single 5 V power supply at band rates from dc to 2 MHz. Both the transmit and receive sections are fully buffered, and the device can operate in the full or half-duplex mode. Features include: programmable sync or secondary address register, programmable CRC generation and checking, programmable character length selection, automatic detection and generation of special control characters, automatic zero deletion and insertion, common parameter register and TTL compatibility.

RS-232 ASC11 BAR CODE READER

Anderson Digital Equipment can supply the Model 9210 RS-232 ASCII Bar Code Reader manufactured by Intermec.

The 9210 transmits information to the computer by drawing an imaginary line through the bar-code with the tip of the Ruby Wand light pen. The code is bi-directional.

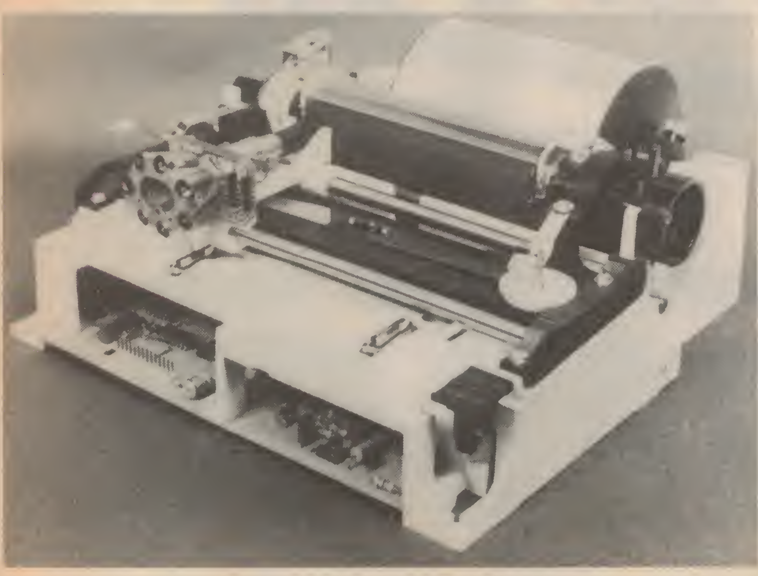
Intermec has chosen the ASCII code transmission format and the universally accepted RS-232C interface. For further information contact Anderson Digital Equipment, Sydney, 439 5488; Melbourne, 543 2077.

NEW ELECTRONICS SHOP IN SYDNEY

A new electronics supply company, Dick Woods Electronics, has just opened on Sydney's north shore. Situated in Hornsby, not far from Hornsby Hospital, the store is primarily involved in the importing and sales of CB gear and accessories but is now beginning to market components as well. A range of ETI kits is also planned. The company is partly made up of ex Dick Smith and Applied Technology staff.

A mail order service is currently being set up and a catalogue is planned for the near future. As an introductory offer to promote their component service they have decided to make components available to the general public at cost price plus freight and handling. This offer applies initially for a six week period commencing May 1 and is limited to orders of $10.00 or more. Although their range is fairly limited, as yet, they will make every effort to obtain any items ordered which they do not presently stock. The retail outlet of Dick Woods Electronics is situated at 77 Edgeworth David Rd., Hornsby, 2077 NSW. Tel. (02) 484238.

LOW-PROFILE 12V PRINTER



Philips Electronic Components & Materials has introduced the new 115DR character printer for data processing terminals, communications, instrumentation and point-of-sale terminals. Philips claims it is the first to be powered by only a single 12 V dc supply. With a profile of 100 mm, a weight of 3 kg and a tough environmental specification, the new printer also brings high-speed hard copy to mobile users. Doctors, fire brigades, police and ambulance services can receive messages, street maps, patient records and other vital information in clearly legible printed form at a rate of 66 characters per second. Up to 40 characters of 2 mm width and 2.92 height can be printed on a single line 96 mm long.

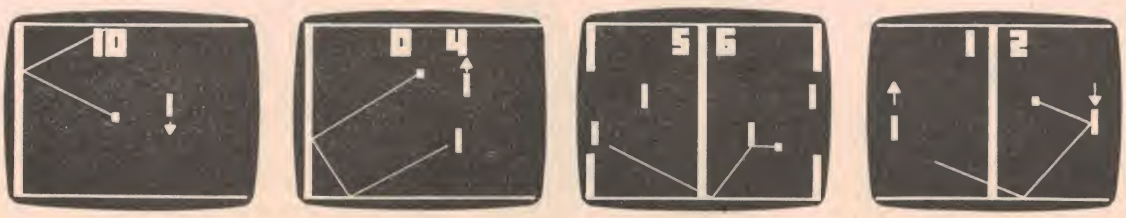
Facsimile reproduction is easily possible with the new printer. The line spacing may be set so that continuous vertical lines may be formed seven dots at a time with each passage of the printer head. If information is transmitted dot-by-dot as a data transmission a picture or diagram is rapidly built up.

The new printer comes complete with printer head and ribbon system, paper roller and feed mechanism and motor control electronics. The character generator and amplifiers for the head solenoids are not included.

GAMES TO PLAY ON YOUR OWN T.V. SET!

NOW AVAILABLE in KIT FORM or FULLY ASSEMBLED

Solo Squash Squash Football Tennis



PLAYTECH by

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LOWEST PRICE EVER!

- Full kit supplied for simple asembly by means of 8 self tapping screws. No metal working required. Silk screened circuit board and pre wound coils. Easy to align for stable and trouble free operation.
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ADDRESS ....

I enclose cheque/money order for $....... in payment

PLEASE ADD $1.50 FOR PACKING AND POSTAGE FOR EACH UNIT ORDERED

Top Disc Cutting Studios, like The Mastering Lab, rely on Stanton's 681-Calibration Standard in their Operations.

Not everyone who *plays* records needs the Stanton Calibration Standard cartridge, but everyone who *makes* records does!

At The Mastering Lab, one of the world's leading independent disc mastering facilities, the Stanton 681 Triple-E is the measuring standard which determines whether a "cut" survives or perishes into oblivion.

A recording lathe operator needs the most accurate playback possible, and his constant comparing of lacquer discs to their original source enables him to objectively select the most faithful cartridge. No amount of laboratory testing can reveal true musical accuracy. This accuracy is why the Stanton 681 Series is the choice of leading studios.

When Mike Reese, principal disc cutter at The Mastering Lab, plays back test cuts, he is checking the calibration of the cutting channel, the cutter head, cutting stylus, and the lacquer disc. The most stringent test of all, the evaluation of direct to disc recordings, requires an absolutely reliable playback cartridge . . . the 681 Triple-E.

All Stanton Calibration Standard cartridges are guaranteed to meet specification within exacting limits. Their warranty, an individual calibration test result, comes packed with each unit. For the technological needs of the recording and broadcast industries, and for the fullest enjoyment of home entertainment, you can rely on the professional quality of Stanton products.

STANTON

Sole Australian Distributors:

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Available at quality conscious Hi-Fi dealers throughout Australia!

LER 146

WIN A CB RIG

The next issue of CB Australia, number five, will feature a contest sponsored by MS Components. The prizes include a Sidewinder III mobile CB transceiver, a CB Signaliser, and other goodies for the runners-up. The contest is open to all readers of CB Australia and ETI — if you win a piece of radio gear and you are not a ham or CBer then you can swap your prize for other goods of equivalent value.

CB Australia number five will be presented free inside the June issue of ETI. It will include a series of reviews of AM/SSB transceivers.

March Calculator Contest

The winner of the March Unitrex Calculator contest is Mr G. Ziemelis of Athelstone, SA. The correct answers are (1) BIG LOSS, (2) Fibonacci (3) Eduard Lucas.

PHOTOACOUSTIC SPECTROMETRY

Tecnico Electronics has announced a new type of analytical instrument — the Princeton Applied Research Model 6000 Photoacoustic Spectrometer. In the past, measuring the optical absorption spectra of opaque solids and liquids has been extremely difficult, if not impossible. With this new instrument — the first of its kind in the world — an enormously wide range of materials such as metal powders, crystals, biological samples, smears, dense liquids, etc can now be routinely analyzed.

Put simply, the PAS technique consists of placing the sample material to be analyzed into a specially designed airtight cell equipped with a sensitive microphone. Through a window in the cell, the sample is exposed to chopped, monochromatic light. Any light absorbed by the sample will cause a temperature fluctuation at the sample surface which, in turn, will cause a cell pressure fluctuation which is detected by the microphone and electronically processed.

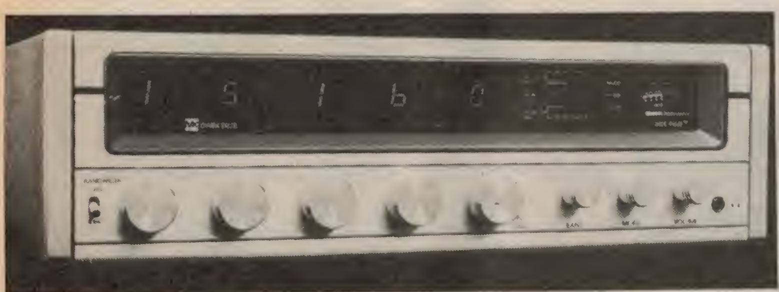
A free 8-page Application Note on this new technique is available from Tecnico Electronics, Premier Street, Marrickville, NSW, 2204, or from Tecnico Electronics, 2 High Street, Northcote, Vic. 3070.

Win A Unitrex Calculator!

This month's contest was sent in by K Wallace of Nords Wharf:

A missionary who had a gold chain with 159 links was captured by a group of cannibals (as are most missionaries in mathematical problems), who stipulated that he could purchase one day of freedom for each single additional link of the gold chain that he gave them. They agreed to accept the principle of "change-making" (ie, he might give them a 7 link section, if they had 6 links to give him in change). The missionary's goldsmith charged an exorbitant rate for making each cut link whole again. What is the minimum number of links that he had to cut in order to assure his existence for 159 days (at which time he knew that he would be rescued)?

Here's a clue — despite the exorbitant rate charged by the goldsmith all the cut links are re-joined. Send your answer on the back of an empty envelope (don't forget to add your name and address) and send it to Unitrex Calculator Contest (May), ETI Magazine, 15 Boundary Street, Rushcutters Bay, NSW 2011. Closing date is 15th June 1977.



DIGITAL COMMUNICATIONS RECEIVER

The McKay Dymek Company is now shipping its new DR-22 all wave, fully synthesized, communications receiver covering the frequency range of 50 kHz to 29.7 MHz. The firm claims the DR-22 is the first fully synthesized, digital readout receiver available for less than $2,900.

The DR-22 comes equipped with switch-selectable 4 or 8 kHz band width ceramic filters. Preceding the ceramic filters are crystal filters at 30 MHz and 10.7 MHz for excellent overall selectivity and protection from intermodulation and cross modulation interference.

The receiver runs on either 110-120 or 220-240 V, 50-60 Hz. The price is $995.00. Write to McKay Dymek Co., 675 N. Park Ave., PO Box 2100, Pomona, Ca. 91766, USA, for further information.

Calculator Pen in Australia

The Calcu-Pen appeared in the American magazines around the middle of last year — a four-function plus per cent 8-digit calculator built into a ball-point pen — and now it is available in Australia for approx. $50. Contact CWB Holdings, 71 Clarke St, Prahran, Victoria, 3181.

QUAD TIMER

Signetics SE/NE558 and 559 quad timers, now available from Philips Electronic Components and Materials, are monolithic timing devices which can be used to produce four entirely independent timing functions. The SE/NE558 output sinks current and the SE/NE559 sources current.

All sections are edge-triggered; when connected in cascade for sequential timing applications, no coupling capacitors are required. The output current per section is 100 mA. The SE/NE558 and 559 have wide supply voltage ranges from 4.5 to 16 V.

HIGH RESOLUTION FFT SPECTRUM ANALYZER

Princeton Applied Research's new FFT Spectrum Analyzer, the Model 4513, provides 2.5 to 5 times the frequency resolution of similarly priced competitive analyzers. A 4096 point transform is performed on the input data. A unique display feature allows switch selection of either 2048 or 1024 spectral lines.

A dynamic range of 60 dB is guaranteed. A four digit LED display provides direct readout of frequency and amplitude. Digital outputs are standard. The Model 4513 can be used in a wide range of applications such as Fourier Transform Spectroscopy, Noise Analysis, Acoustics, Vibration Studies, and Musicology, to name a few. For further information contact Tecnico Electronics, Premier Street, Marrickville, NSW. 2204, or Tecnico Electronics, 2 High Street, Northcote, Vic. 3070.

NOW!

seven ways to beat the odds...

CARTRIDGE AND STYLI SPECIFICATIONS

Replacement Stylus	Stylus Grip Color	Output (1 kHz at 5 cm/sec peak recorded velocity)	Frequency Response	Channel Balance	Channel Separation (minimum)	Tracking Force	Trackability (Peak Recorded Velocity)
N70EJ 10 x 18μ (.0004 x .0007 in.) Biradial (Elliptical)	Light Green	6.2 mV	20 to 20,000 Hz	within 2 dB	20 dB at 1 kHz	1½ to 3 grams	400 Hz – 20 cm/sec 1,000 Hz – 26 cm/sec 10,000 Hz – 11 cm/sec at 2 grams
N70B 15μ (.0006") Spherical	Beige	6.2 mV	20 to 20,000 Hz	within 2 dB	20 dB at 1 kHz	1½ to 3 grams	400 Hz – 20 cm/sec 1,000 Hz – 26 cm/sec 10,000 Hz – 11 cm/sec at 2 grams
M70-3* 64μ (.0025") Spherical	Dark Green	6.2 mV	20 to 20,000 Hz	—	—	1½ to 3 grams	————

*Optional 78 rpm Stylus: Set amplifier to "MONO" or "A + B."

NET WEIGHT: 5.8 grams

INDUCTANCE: 720 millihenries

DC RESISTANCE: 630 ohms

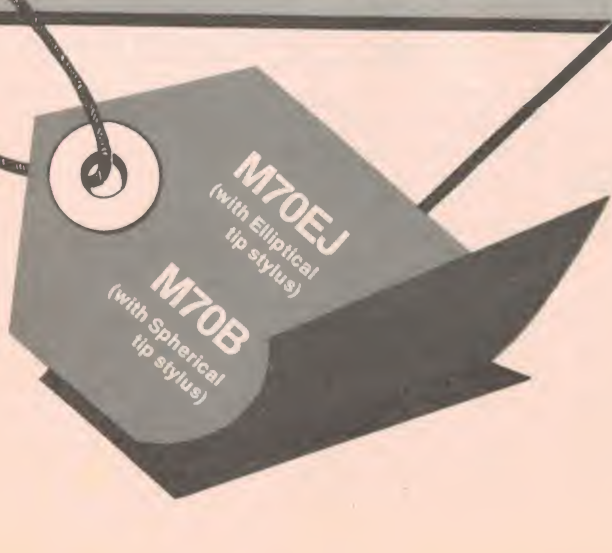
OPTIMUM LOAD: 47,000 ohms resistance in parallel with 400 to 500 picofarads total capacitance per channel.

FULL ONE YEAR WARRANTY: Shure Brothers Incorporated ("Shure") warrants to the owner of this product that it will be free, in normal use, of any defects in workmanship and materials for a period of one year from date of purchase. You should retain proof of date of purchase. Shure is not liable for any consequential damages. If this Shure product has any defects as described above, carefully repack the unit and return it prepaid to your dealer, or the Shure Service Centre in Australia — Audio Engineers Pty. Ltd., 342 Kent St., Sydney, N.S.W., 2000, for repair. The unit will be repaired or replaced and returned to you promptly. This warranty does not include stylus wear.

PATENT NOTICE: Cartridge and stylus manufactured under one or more of the following U.S. patents: 3,055,988, 3,077,521, 3,077,522, and 3,463,889. Other patents pending.

SHURE®

- The response curve is basically flat within the audible spectrum. *Comparable with cartridges costing twice the price!*
- Trackability is the measure of a cartridge's *total* performance. This cartridge has excellent full frequency trackability with an *exceptional* capability to track the highly modulated passages of most records.
- The 1½ to 3 gram tracking force range means the M70 cartridge series is suitable for the vast majority of stereo systems made today.
- Besides backing our cartridge with a full one-year warranty, we also assure you that our genuine replacement styli will restore your cartridge assembly to the exact original specifications—no matter where in the world you buy the genuine Shure N70B (spherical tip stylus for the M70B cartridge model), the N70EJ (elliptical tip stylus for the M70EJ cartridge), or the N70-3 (optional 78 rpm stylus).
- Only Shure can deliver this caliber of technology for high fidelity cartridges.
- From the same engineering team that created the incomparable V-15 Type III cartridge. Our unbroken track record in 18 years of stereo high fidelity is your assurance of quality.
- No other cartridge offers this much performance at such a low price.



M70EJ & M70B cartridge series... the *better* bargain

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- Audio Engineers (Qld.) Pty. Ltd. 57 Castlemaine St., Milton. Qld. 4064
- Athol M. Hill Pty. Ltd. 33-35 Wittenoom St., East Perth. W.A. 6000

AE117/FP

DO YOU NEED A SPORTS TIMER?

We are planning to design a digital stopwatch for use by sportsmen, their coaches, and their spectators. Basically the timer will consist of a digital clock which starts at the press of a button or when a suitable signal is fed into a socket and the elapsed time is displayed in hours, seconds, and decimal seconds. Other facilities could include any number of 'latches' — when you press a button or feed in a control signal the time on the display at that instant is frozen in a memory for displaying on a separate display or on the main display when a switch is operated.

So far we would have a timer capable of giving times for, say, eight competitors in the same event, and, with the facility to clear the latches, times at the end of any lap can be recorded. But times for laps other than the first cannot be read directly — you have to subtract the time at the end of lap five from the time at the end of lap four (which is lost when you latch lap five) to get a lap time.

We could therefore add, at some expense, sophisticated facilities like circuits to give lap times; these would act as separate timers whose starting and stopping times were independent of the master timer (or they could all stop when the master timer stops).

Then we could add a lap counter — now the project could give you readings like: total elapsed time, lap number, times for each competitor at the completion of the last lap (to tell you who's winning), and individual lap times. Further we could, if it was worth it, put circuits into the timer to rank the competitors at the end of each lap.

We have so far looked at timers, counters, latches, and simple arithmetic functions. Another circuit we could add would be a comparator — you could feed a number into the device (using thumbwheel switches or maybe a keyboard) and ask it to compare this nnumber to one of the timers or counters. Then an alarm output could tell you when 400 seconds have elapsed, or when 50 laps are completed, etc.

A simpler comparator could detect zero in a count-down timer, but you'd have to put a starting number/time into the device before you press the start button. Rather than inserting numbers by digit, we could use a circuit that had a fast-count button which you hold down until the desired number comes up on the display (or very-fast-count, fast-count, and slow-count buttons?).

We could provide BCD or seven-segment outputs to drive slave displays or giant scoreboards, or outputs for bar or circular displays to give an at-a-glance indication of elapsed time (or time left to play) — using rows of LEDs or globes.

We *could* provide more facilities, virtually anything you ask, but we don't expect to be able to do this *and* please the majority of our readers. So we're going to try something new — we're asking you, the readers, to find the right compromise for us. You can't have all the facilities described here. If you could have only about half of them which would you pick?

To make it easier to evaluate your suggestions could you please keep to the following order in your submission.

(1) Name the sports you wish to time (2) Name the amount of money you would be able to spend on parts (3) What are your requirements for the master timer (max. time, min. resolution, button or electronic switches)? (4) How many competitors do you want to simultaneously monitor? (5) What information do you need about each of these competitors? (7) How many displays per competitor? What kind of displays? (8) If you have other suggestions or ideas about how to approach the project please put *brief* notes here.

Bear in mind that we are asking you to compromise — don't ask for an all-singing/dancing job for $50. Send your ideas to Sports Timer Project, ETI Magazine, Rushcutters Bay, NSW 2011.

ADDENDUM

'High Voltage, High Current Supply', December 76 ETI.

It is theoretically possible with the circuit as it stands to achieve second breakdown of the series pass element Q2 (MJ 413) on **slow risetime switch on** into **full load.** In fact one failure has been observed under these conditions. The recommended modification is to parallel Q2 with another MJ 413 and insert 4.7 5W balancing resistors separately in each emitter lead. With this combination no failures have been observed under extensive testing with the adverse conditions. I should emphasize that no modification is necessary if fast risetime is desired (ie, C2 absent), and similarly if switch on into full load is not anticipated.

MS Components

(Electronics) Pty. Ltd.

TRADING HOURS

MON-TUES-WED & FRI: 9am-5.30pm. THURS: 9am-7pm. SAT: 9am-12 noon. C.O.D.'s: Please add $2.40 to posting fee. NO ORDERS UNDER $4.00 accepted. For replies please send S.A.E. Post and Packing $1.00 where not included in price. PLEASE . . . PLEASE PRINT YOUR NAME & ADDRESS ON ALL ORDERS AND CORRESPONDENCE.

THE GREAT NAME FOR ELECTRONIC COMPONENTS IN AUSTRALIA

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Hi Buffs, Experimenters, CB'ers. Got some good news and some bad news. The bad news first – 'fraid Dick has lost one of his best CB, Electronic, and Component advisers from Gore Hill.

Gary Temple is now at our address as advisor. Now the GOOD NEWS. If you need advice – about CB rigs, antennas, or components – real facts, then come and see Gary. He will tell you the true facts even if it means sending you to the opposition till such times as he can tell you different, AND THAT'S THE TRUTH . . . Here's Gary with some more good news.

First some good news for experimenters. For me there's always been something lacking in kits on the market, and I finally have an inkling of what it is. They are all planned to the last detail and deny us that niggling need to add, to take from and to change them, they deny us the fun of throwing in our own two cents' worth. Most of them we build without really understanding just how they work so we can't readily change them, or they don't work at all. Well, I'm trying to change that. I'm getting some ideas into kits made up of cheap and easy-to-get components mounted into Veroboard. None are overly ambitious or made to serve a specialized function but are basics like oscillators, timers, triggered alarms, counters, frequency dividers. Some transistor, some TTL, some C-MOS, but complete with clear instruction how to build the basic kit and hints and ideas of its possible uses. Most will be worth four or five dollars. If you have trouble with any of these you won't have to cop that blank look from the counter boy when you take it back for help. You can come and see me personally. COME IN, & SEE THESE KITS NEXT TIME YOU'RE PASSING OUR WAY . . . GAZZA

Two transistor oscillator. Suit Continuity Tester. Morse Practise Oscillator. Audio Signal Generator. Switchable Low Frequency Marker. Small Capacity Tester . . . **Just $1.50** **KIT '1'.**

How about this two transistor (LDR) light triggered alarm kit. Suite simple games like, Rifle Shooting with light source, or Find The Bomb game. Just great for parties, try and find the kit in a dark room without activating it armed, only with a flashlight. Experiment with data transmission by light source. Hook it to relay and motor, open your garage doors with your car headlights. A thousand uses . . . **Just $2.50** **KIT '2'.**

Try this two transistor (LDR) darkness triggered alarm kit. Suit Poor Light Photo warning, feed it to a relay and Turn On The House Lights. Great Tail Light Failure warning kit. **Just $2.50** **KIT 3.**

Here's a handy two transistor (LDR) darkness triggered FLASHING, FLASHING, FLASHING alarm kit. Has real possibilities. For late fishermen, an after dark buoy MARKER. Put this kit on your dash and Find Your Car in a big car park after the show. Give clear flashing warning of any light source failure. Industrial applications by the score . . . **Just $2.60** **KIT 4.**

Now, a CB EXPERIMENTER'S KIT, a two transistor miniature transmitter. Works at CB frequencies, puts out about 15mW of tone or voice modulated carrier. Can be picked up by any 27meg receiver sixty to a hundred feet away if the wind's right. Fits into a matchbox. Perfect for tuning receive sections of CB marine units or hand helds, but you'll have to find your own 27meg crystal . . . **$4.50** **KIT 5**

Another CB experimenter's kit, a Constant Volume Output Preamp kit. Add it to telephone amps, intercom systems, PA amps, Tapedecks Cassette recorders, or work it into the audio stages of your short wave communications receiver to eliminate fading. How about; (if you're good, with the aid of our tiny metal film resistors) packing this into the mike of your CB or 144 portable to serve as a mike compressor. WHY PAY $48 for a compressor almost as big as the ARRL hand book when you can experiment with this little bottler for a lousy . . . $4.00 **KIT 6.**

IS YOUR LIFE WORTH THE PRICE OF A KIT??? Any buff at all that uses mains power, (don't we all) can really find uses for this kit. It sniffs out the fifty cycle mains hum radiating from cable, switches, transformers, appliances with absolutely no physical contact. Very handy too for determining if 50cycle AC is about, even if transformed down to low safe voltages. With red diode warning light the kit's worth **Just $3.00 KIT 8 P&P $1.** But for greater sensitivity use the meter kit at only **$6.00. KIT 8A. P&P $1.** **KIT 8**

ALL KITS INCLUDE CLEAR AND COMPLETE INSTRUCTION AND POSSIBLE USES. THEY ARE PRIMARILY EDUCATIONAL KITS FOR THE EXPERIMENTER OR HOBBYIST. BACKUP REGARDING WIDER USES, OR CONSTRUCTION PROBLEMS WITHIN REASONABLE LIMITS MAY BE SOUGHT FROM OUR TOP ELECTRONICS ADVISOR.

Want to pay $15 or $18 for an antenna trimmer 'course you don't (who does?) but then if you don't know how to make a good one, then you havn't got much choice. But now you have a choice. Buy one simple kit. No it doesn't include a box or panel fittings for PL259s, who needs them! Most CB'ers would like to see their trimmer built into their rig or SWR meter, well you've got it, the kit and complete instruction on how to do it with less insertion loss than most commercial units . . . It'll cost you a lousy . . . **$2.50** **KIT 9**

Here's a couple of TTL kits for those of you breaking into ICs. A three IC counting unit, incorporating a 555, a 7490, and 7447. Simple enough for those already into TTL, but an IDEAL kit for the beginner and completely instructed to cater for the beginner. Not to mention a good run down of possible uses for the unit once working and understood by the constructor. This kit is complete with display, five volt regulation, veroboard, wire, solder, battery connections . . . **Just $8.30 plus P&P.** **KIT 10**

Another TTL kit. This one is very much like the one above but the final IC the 7447 is substituted for a 7441 making the kit an eleven led chaser with variable speed control and brightness. Once understood, this kit can be used to drive triacs at the mains for chasers at discos, dances, the local water hole. This kit is absolutely complete and worth just **$8.00 KIT 11 Plus P&P.** **KIT 11**

Ever wanted to build a frequency counter, but not sufficiently inclined or wealthy to come good for a minimum of $100 for the commercially produced kits just yet. Well, try our mini frequency counter kit. Good to about 100k and a lot of fun to build. If you fancy your self as compact experimenter, there's no reason why you can't get this kit into a mini-box of the buck twenty variety. The kit includes board, wire, solder display . . . **Just $16.95 KIT 12 plus P&P $1.** **KIT 12**

Here's a completely experimental kit. It's a simple fact that most of us can't cope with designing filters in audio projects. Well in this kit there's enough components and Clear Instruction to make up and experiment with high, low and band pass filters of both RC and LC construction. Also included in the kit is a variable frequency audio oscillator with sine and square wave outputs and a crystal ear phone . . . **Just $5.50** **KIT 7.**

PNP Car Radio. Transistors 2SB367 — VCE25c 1c 400mA. A $1 special elsewhere around town, but at MS.C. — **75c. A lousy $6.50 for 10.**

NOW SOME GOOD NEWS FOR THE CB'ERS. If you are passing our 10-20 and not on a 10-17 drop in and eyeball and let us give you a 10-9 on our latest. THE ROYCE 23CH CB UNIT.
Not only a 23ch CB but an AM/FM STEREO RADIO too. But it's handsome. GOT TO BE EYEBALLED TO BE BELIEVED. **Yours for $199 even.**

SIDEBAND ... SIDEBAND ... SIDEBAND. Our latest THE JOHNSON 352D VIKING SIDEBAND RIG. This is for the big boys, the ultimate in CB RIGS. The tone and noise suppression is excellent. This unit certainly does not suffer from that real tinny, scratchy, death rattle some other brands of sideband rigs pass for audio output.
COME AND SEE THIS LITTLE BEAUTY, WITH TWELVE MONTHS GUARANTEE ... JUST $289 ... right **JUST $195 for the BEST.**

And now for the road Knight's gear jamming eighteen wheelers. If you want to get above the advertised propaganda splashed every where about CB RIGS, if you want to see CB, talk CB and do it with some one that knows CB, not a counter-jumper, it'll be my pleasure if you drop in. I've sweated my butt off in front of a 22tonne load or two in my time, and hauled wheat back of Moree on dust roads so potted you could lose your spare tyre in some of the holes if it fell in. You tell me what you want out of CB and your driving conditions I'll tell you your best buy. If we haven't got what I reckon you need, I'll send you to who has, that's no bull-bar. Something I don't need is a 16 stone interstate gear jammer after my butt cause I pointed him the wrong way.

NOTE ... **KNOBS** ... Knobs for your hi-fi equipment — CB and projects. We've got some beautiful solid aluminium machine turned knobs, all sizes all styles at fifty to eighty cents each. THESE ARE REALLY PRETTY.

And now just to come back for the final, we've got a range of antennas from helicals to baby gutter mounts, **$29 to $19.95** all covered, RF signalizers at **$42**, extension horns and PA speakers around ten, eleven bucks, good quality PL259s at **$1.95** and the CALCOM CB BOOKS, at about four bucks. If you can't get in right now, at least give me a bell on the land line. Well for now I'll back up and stand on the side, perhaps catch you on the co-ax . . . **I'm gone.**

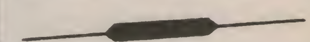
Got some news for the Buffs too. Now I admit that working in the trade makes getting hold of parts a little easier. But I haven't forgotten at the beginning; the searching for good buys and lovingly cleaning up already used components. I guess it's force of habit that keeps my eyes peeled for good buys as new stock comes in, and this month it looks like we've got plenty.

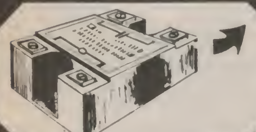
TRY THESE PRICES ON, WOULD I LIE,?

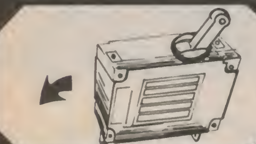
I found some solid state relays too. Anyone working with alarm systems will find use for these. They'll carry 5 amps and 250 V switch and need 3 to 32 V volts to work efficiently. They're about five by five centimetres by three deep, solid encapsulation. The weather won't hurt these . . . yours for **$3.50 each. Plus P&P $1.**

Bundles of hook up wire in all colours and lengths with pre-stripped ends. I figured if I mixed up the colours some and made up a fist size bundle of assorted lengths, with hook-up wire ten cents a meter off the roll now-a-days, a decent bundle would have to be worth a **$1.00.**

RESISTORS. Metal film, half watt (bout the size of normal one-eighths) for a lousy three cents each. Almost every popular value covered up to the meg range. **3c Plus P&P.**



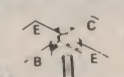




Something for the serious buff with some bread to spare. Saw some three digit digital multimeters with the test instruments the day I started here. I've been giving the demo model a hard time since at work and at home on the work bench. Takes four C cell batteries and is about the size of the average 20k vom. Did all I wanted. Considering the prices around town for digital multimeters, its portability and size, **it's good value at $125.**

I admit when it comes to speakers, turntables, crossovers and the like I'm done, out of my depth, just not my bag, but I couldn't help notice a new blank cassette in stock called G TAPE, C90. It's guaranteed to have a 20 to 20k response, screwed case, and written guarantee against faults in material and workmanship. Sounded good value to me at only **99c plus P&P.** What do you audio buffs think?

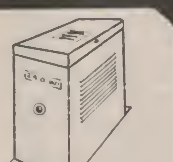
SUPER SPECIAL, JUST IN. **RF TRANSISTORS,** Good to 470megs, at two watts output, Photo copy of specs available for 20cents. Would be perfect as drivers for that FM LINEAR. Only four hundred in stock, and they will not last long at only $1.95 each.



A SUPER EXTRA SPECIAL, 10 FOR ONLY $15.

Found some Lag switches (circuit breakers) out back. Neat, small, one amp drop-out. Electricians, and you buffs working with power supplies will find good uses for these. **Just $2.00 each plus P&P.**

WE HAVE A REAL SPECIAL FOR THIS MONTH ONLY



CB POWER SUPPLY But Good

All Parts — including approved 3AMP Star Delta Transformer. 3AMP 200V Bridge Rectifiers complete with full building instructions. **$42.50. P&P $6.00.**
We've got good stocks of the 3AMP 200W full wave recs (filtered) if you've got your own trans. **They are just $2.00. Plus P&P 50c.**

MSC QUICK LIST

S.W.R. METERS, three types in stock. Single meter, $16. ASAHI dual meters, $29. TOYO, model YM-IE dual meter only $31. ONE WATT HAND HELDS, Two PL259's, with 100cms co-ax inbetween, $3.00

CURLY CORD for that mike. $1.50. AMPHENOL PL259's, COMPLETE WITH REDUCING ADAPTOR, $1.95. Got ELBOWS, T PIECES, and JOINERS to sell with our CO-AX to COME IN, SEE. PLEASE DON'T FORGET P&P IS EXTRA.

PAC No.	CONTENTS	PRICE
SC. 2	100 Assorted T018 & T05 NPN & PNP Silicon Transistors	$2.50
SC. 3	5 T066 (2N3054 Series) Transistors & 5 MS3055-1 (Marked) Power Transistors	$0.90
SC. 4	100 100V 3 amp Plastic Rectifiers	$4.50
SC. 5	100 100V 5 amp T05 Metal Case Rectifiers	$5.00
SC. 6	20 2N3055-1 (Unmarked) Power Transistors	$3.00
SC. 9	50 EM402 Diodes, 200V 1 amp	$3.00
SC. 10	50 EM404 Diodes, 400V 1 amp	$3.75
SC. 11	50 EM406 Diodes, 600V 1 amp	$4.00
SC. 12	50 EM408 Diodes, 800V 1 amp	$4.25
SC. 13	50 EM410 Diodes, 1000V 1 amp	$4.75

Electronics Training in the Air Force

Steve Braidwood's report on his visit to the RAAF School of Radio.

(Below) The RAAF School of Radio at Laverton, Victoria. The school moved to this new building in December 1974.

ELECTRONICS TRAINING, that's what the ad says, which covers communications, computer principles, radar, etc. Then after training you get almost ten thousand dollars a year.

Ten thousand dollars for doing what? How long does it take to finish training and get down to work? What are the conditions like, how good is the training when you are looking for a job on Civvy Street?

And those readers who are in a position to recruit electronics staff might like to know what to expect from one of these 'electronics specialists'.

At the invitation of the RAAF Recruiting Publicity Office I armed myself with these questions and went down to the place where adult trainees learn their skills — the School of Radio at the Laverton RAAF base.

Adult Technical Training

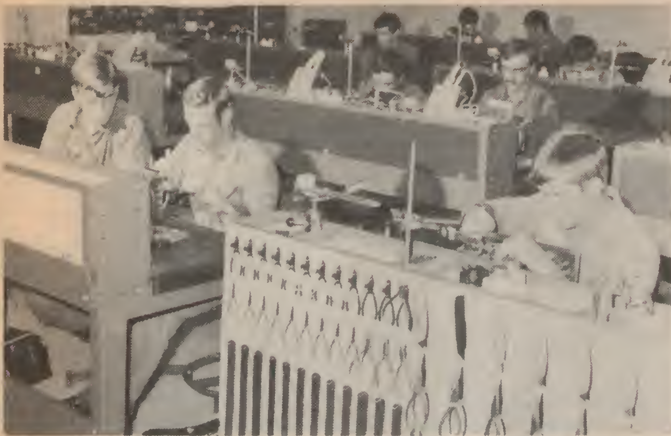
Adult technical training is given at two RAAF schools: Wagga, NSW, is the place for electrical and mechanical trainees, and at Laverton, Victoria, the speciality is electronics. Trainees have to decide their trade before starting training and from then on they follow a specialised course, Radio or Electrical/Mechanical.

Adult trainees ('adult' entry is for 17 to 34-year-olds) choose one of three courses at the Radio School. All three train recruits to maintain the electronic equipment that the airforce relies on for communications, surveillance, navigation, etc.

Graduates become Airmen on pay level six — the top level. Specifically, the three trades are: Radio Technician, Ground; Radio Technician, Air; and Telecommunications Technician. The suffixes 'Ground' and 'Air' refer to the type of equipment the technician maintains — all technicians work on the ground at an RAAF base, they do not (normally) go up in the plane.

So that's the job you train for — you become part of a maintenance team at a base and it is your job to keep the gear in good order. The equipment you work on is generally bought from private companies and is built to a very high standard. Usually it is very expensive and because it was built so well in the first place much is still in first-class order after years of service (so don't be surprised to find valves being used!).

The newly graduated technician does not have sufficient training to meet the air force's standards for being completely responsible for a specific equipment system. The school runs post-



This classroom is where the trainee learns how to solder. The instructor explains a particular soldering job on the blackboard and straight away the trainee tries it out using his temperature-controlled iron.

The physical environment of RAAF electronic equipment is very harsh, and the average solder joint won't stand up to the vibration. At the Radio School the trainees learn high-reliability soldering to NASA standards; courses are also conducted for instructors from the RAAF and other organisations.

graduate courses to give this specialist training where necessary. For a year or so after graduation the technician will work as part of a team — under the supervision of a more experienced technician.

The Courses

New recruits don't get straight into technical training, first they go to Edinburgh, South Australia, for ten weeks of recruit training. Then they arrive at the Radio School where training is organised in two parts — with the Initial Training Squadron and with the Advanced Training Squadron.

Initial Training Squadron

The first three weeks at the school are spent bringing everyone's maths up to standard. The remaining 27 weeks in Initial Training Squadron are evenly split into three parts: Elect-1, Elect-2, and Elect-3. Elect-1 covers the fundamentals of dc and ac. Elect-2 goes on to study amplifiers, and Elect-3 looks at wave generation and shaping.

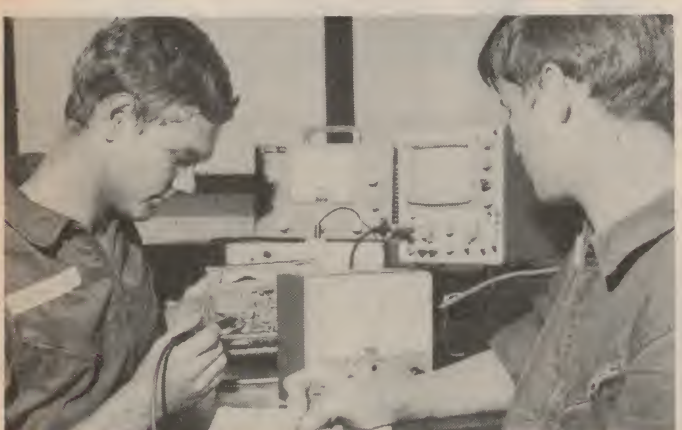
Concurrent with the theoretical work the trainees develop their fitting and handskills. The school is equipped with workshops for metal work and the photographs show the soldering facilities. I was very impressed by the equipment and techniques used to obtain high-reliability solder joints (involving such disciplines as cleaning the solder before applying the iron!). NASA standards and techniques formed the basis of the course and trainees use Royston tool kits and Adcola controlled-temperature irons, as shown in the photographs. With hundreds of dollars-worth of equipment no-one can blame the tools for bad workmanship.

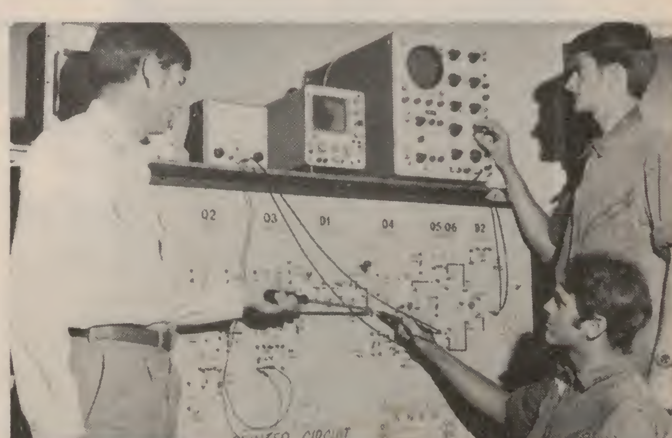
Advanced Training Squadron

The first nine weeks in the ATS is devoted to digital electronics. The trainee works with teaching aids developed by the staff of the school and learns how he can test gear to check if the logic elements are working correctly. The school has a rack of boards with enough of each basic logic circuit to go around the class. The emphasis is on recognising whether the circuits are working correctly. It is common teaching practice to deliberately manufacture a fault in a circuit and see that the trainee follows the correct approach in locating it. The course does not go into much depth in the complicated area of designing logic systems.

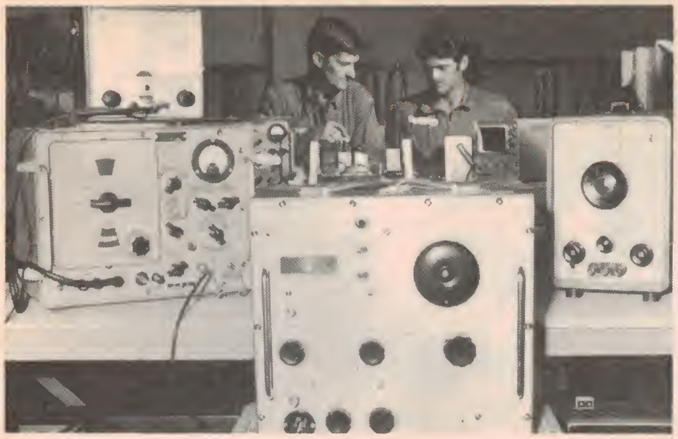
After the logic training (Elect-4) the Ground, Air and Telecommunications technicians breakout for Elect-5 and Elect-6. These final two parts of the course, each of 12 weeks, cover communications, control electronics and radar. Previously the trainee will have learned to deal with the individual blocks as they are joined up systematically to form a piece of actual equipment.

The school has a range of representative equipment for the trainee to practise on. Now he puts together the





Before the trainee can maintain the complex equipment used in the Air Force he has to know how to use the test instruments and how to diagnose faults in simple circuits.



Some of the equipment that the Radio Technician will be working with after graduation. As an undergraduate he does not get specialist training on any specific equipments.

In the Advanced Training Squadron the trainees see how the building blocks of electronics (covered in the Initial Training Squadron) fit together. This block diagram explains the operation of a UHF transceiver.

skills learned in the previous year as he tackles real maintenance problems. Apart from the radio communications equipment used at the bases and in the air, the school has direction finding gear from aircraft and control towers, plus radar and its own full-scale computer. The school has recently installed a new minicomputer which will now be standard throughout the airforce.

Instead of Elect 6 the telecommunications trainees look specifically at telecommunications theory and systems.

That completes the 59 weeks of adult training. Adult trainees are in classes of about 24 which start every month (as the course lasts about 15 months, there are 15 classes under tuition at any time). That adds up to nearly 400 trainees. The instructional staff numbers about a hundred and the school is served by about seventy support staff. Examinations are taken throughout the course and this fits well the staggered entry scheme — examiners are continuously occupied setting and marking papers and should any trainee fail an exam he only has to be put back one month to resit (not a whole year).

Apprentices

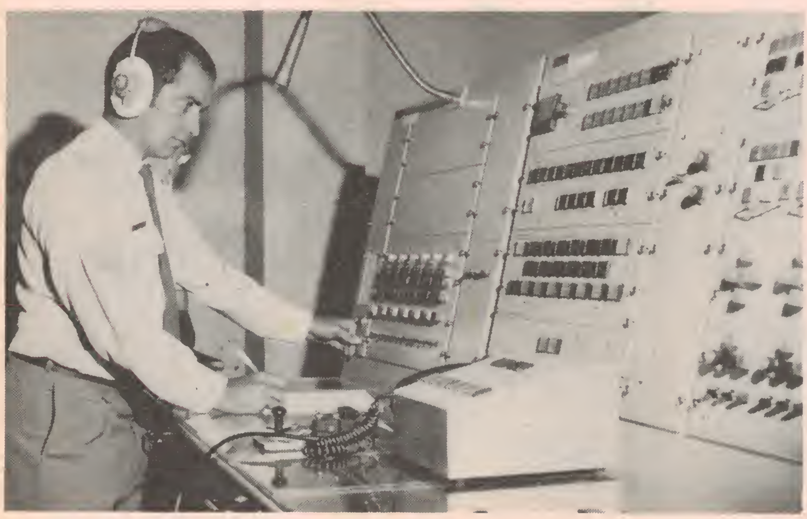
As well as the 17 to 34 year-olds on the Adult Training the Radio School takes on apprentices — straight from school. Apprentice training takes 2¼ years and all this time is spent at the Laverton base. Apprentices are eligible only for the Radio Technician courses (not for telecommunications). Their syllabus in electronics is equivalent to the 'adult' syllabus but in addition the curriculum includes sporting and other general tuition.

Conditions

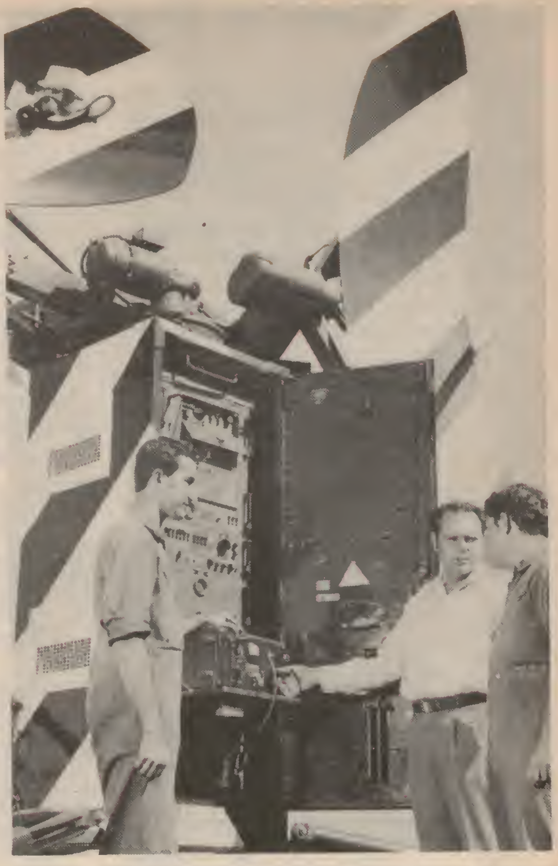
The school itself is very modern and well equipped — the building has been in use only since December 1974. The complex covers an area of 3¼ acres and has 77 offices, 81 classrooms, 7 workshops, a theatrette, a library, plus tea rooms, changing rooms, etc. The grounds, at the Laverton RAAF base, are very pleasant.

All the apprentices live-in at the school and adult trainees can do the

To test the trainee's handskills he is required to make a piece of electronic equipment — a superhet radio is suggested but he can choose his own project if he wants — and many choose projects from ETI.



This console shows trainee technicians and operators what to expect at the base when they graduate.



same. Married trainees cannot be offered family accommodation on the base but they can often be accommodated in RAAF houses nearby.

The school has its own Sabre aircraft (minus wings, etc) to show trainees the air equipment in situ. This chap is dialling up a frequency on the synthesizer of the UHF transceiver.

The Quad radar can pinpoint an approaching aircraft to enable the controller to guide it in for a landing. The system at the school is used to train technicians at undergraduate or postgraduate level.

Pay

Apprentices are paid the following weekly rates during the three years of training — $64.34, $84.25, $114.89.

Adult trainees are paid the following weekly wages: recruits $130.91; first-year trainees, $135.61; second year trainees, $155.52.

On graduation the trainees are paid as level 6 airmen, at $191.09 a week. On promotion to sergeant this becomes $207.18.

From this the members have to pay $17.50 per week for accommodation and meals.

Service

The apprentice is required to serve for nine years and the adult trainee for six — and this includes the training period.

Other Courses at Radio School

In addition to training technicians the school runs courses for operators of telecommunications equipment. There are also post-graduate courses for technicians and operators. Technical postgraduate training courses last an average of six weeks and they cater for the specialist needs of Radio Technicians, Ground, and Telecommunications technicians (Radio Technicians, Air, are given specialist courses at the bases where they work). The Radio School courses teach specific equipments used for radar, direction finding, communications, data handling, etc. One post-graduate course lasts 39 weeks — to train technicians to maintain the air force's minicomputers.

RAAF Cadets

After my visit to the Radio School at Laverton I called in at the Engineering Cadet Squadron, RAAF Frognall, in the Melbourne suburb of Canterbury. Here are residential quarters for undergraduates participating in the Engineer Cadet Scheme. The cadets are enrolled for four-year degree courses at Melbourne colleges (mainly the Royal Melbourne Institute of Technology) in Aeronautical, Mechanical, Communications or Electronic Engineering.

The cadets apply at the time they apply to university and the Air Force selects a small number of these — about twenty-five are picked for communications and electronic engineering. Accepted cadets starts in January — about six weeks before the academic year starts. They are instructed in service subjects (administration, weapons, English, public speaking, and drill) and go on trips to bases, etc.

In term-time the cadets arise at 6.45 and after breakfast they go to college by air force bus. They wear civilian clothes during the day and are taken back to Frognall by bus in the evening. After dinner on Monday to Thursday they have a period of supervised study — Friday and Saturday nights are free for

The school has its own library.

Electronics Training in the Air Force

leave. Third and fourth year cadets get week-end leave, if they wish. The degree courses studied are standard courses organised by the colleges and the cadets study alongside civilian students.

The Frognall squadron is based in a characterful house built in 1890. The cadets have their own rooms and mess and they have facilities such as TV, billiard and recreation rooms and bar.

On graduation the cadet is commissioned as a Flying Officer on a salary of $10,828. Cadets who cannot meet the degree standard might qualify for a diploma in their subject and these are commissioned as Pilot Officers for a year (the diploma course takes only three years) before promotion to Flying Officer. After three years and passing a promotion exam the Flying officers are promoted to the rank of Flight Lieutenant, currently worth $12,947 ($15,876 after five years).

The pay for Officer Cadets goes as follows — $4813, $5433, $6054, $6674 for the four years of study.

All photographs courtesy of the Central Photographic Establishment.

Where To Apply

Application forms and further information can be obtained from Air Force Careers Officers at the following addresses:

NEW SOUTH WALES

Air Force Careers Officer
Defence Force Recruiting Centre
Central Square Building
323-337 Castlereagh Street
SYDNEY NSW 2000
Phone: 212-1011

Air Force Careers Adviser
Defence Force Recruiting
Information Centre
587 Hunter Street
NEWCASTLE NSW 2300
Phone: 25-476

Air Force Careers Adviser
Defence Force Recruiting
Information Centre
266-268 Crown Street
WOLLONGONG NSW 2500
Phone: 28-6492

VICTORIA

Air Force Careers Officer
Defence Force Recruiting Centre
Reliance House
301 Flinders Lane
MELBOURNE VIC 3000
Phone: 61-3731

QUEENSLAND

Air Force Careers Officer
Defence Force Recruiting Centre
Watkins Place,
288 Edward St,
Phone: 22 62626

Air Force Careers Officer
Defence Force Recruiting Centre
135-139 Sturt Street
TOWNSVILLE NTH QLD 4810
Phone: 71-3191

SOUTH AUSTRALIA

Air Force Careers Officer
Defence Force Recruiting Centre
125-127 Pirie Street
ADELAIDE SA 5000
Phone: 223-2891

BECOME AN ELECTRONICS TECHNICIAN IN TODAY'S AIR FORCE.

If you're interested in radio equipment, navigation aids, radar and advanced telecommunications equipment, then why not let the Air Force train you as an electronics technician.

As an adult trainee between 17 and 34 on entry you'll work with people your own age on good pay — $9,445 per year on completion of training. You'll have the chance to travel, and a good job with a secure future. And when eventually you leave us you have a trade always in demand in civilian life. Training is free, so is medical, dental and optical care, and you'll become eligible for a $15,000 low interest housing loan.

So if you're an Australian citizen or can meet our nationality requirements and have good results in English, Maths and Science, give the Air Force a call. Your future's in your hands.

To RAAF Careers Officer, GPO Box XYZ (Insert your nearest Capital City and Postcode) Please send me full details about electronics training in today's Air Force.

Name ____________________

Address ____________________

Date of Birth __________

State __________ Postcode __________

YOUR FUTURE'S IN TODAY'S AIR FORCE.

RG 49.FP.37

555 TIMER APPLICATIONS

DESCRIBED BY R. M. MARSTON PART 2

Part two looks at some basic multivibrator circuits. In the next part we will look at various applications circuits for the astable multivibrator.

MONOSTABLE PULSE GENERATOR CIRCUITS

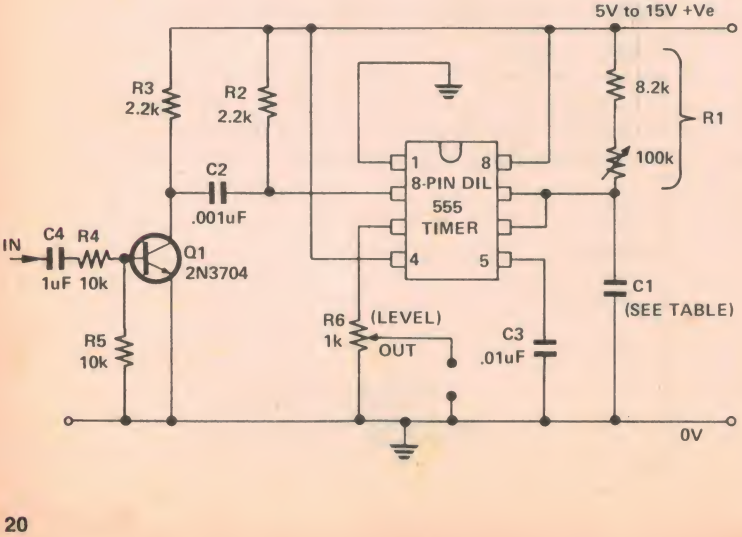
All the 555 timer circuits that we have looked at so far act essentially as monostable multivibrators or pulse generators. The 555 can be used as a conventional electronically-triggered monostable multivibrator or pulse generator by feeding suitable trigger signals to pin 2 and taking the pulse output signals from pin 3. The IC can be used to generate good output pulses with periods from 5 µs to several hundred seconds. The maximum usable pulse repetition frequency is approximately 100 kHz.

The trigger signal reaching pin 2 must be a carefully shaped negative-going pulse. Its amplitude must switch from an OFF value greater than 2/3Vcc to an ON value less than 1/3 Vcc (triggering actually occurs as pin 2 drops through the 1/3 Vcc value). The pulse must have a width greater than 100 ns but less than that of the desired output pulse, so that the trigger pulse is removed by the time the monostable period terminates.

One way of determining a suitable trigger signal for the 555 monostable circuit is to convert the input signal to a good square wave that switches between ground volts and the full positive supply rail voltage, and then couple this square wave to pin 2 of the IC via a simple short time-constant C-R differentiating network, which converts the leading or trailing edges of the square wave into suitable trigger pulses. Figure 10a shows a practical circuit that uses this basic principle, but is intended for use only with input signals that are already of square or pulse form.

Here, transistor Q1 converts the rectangular input signal into a signal that switches between the ground and positive voltage rails, and the resulting signal is fed to pin 2 via the differentiating network. The circuit can be used as an add-on pulse generator in conjunction with an existing square or pulse generator. Variable-amplitude output pulses are available from pin 3 via variable potential divider R6. The output pulse widths can be varied over more than a decade range via R1, and can be switched in overlapping decade ranges by using the values of C1 listed in the table. With the component values shown the pulse width is fully variable from 9µs to 1.2 seconds. Note that C3 is used to decouple the pin 5 CONTROL VOLTAGE terminal and improve the circuit stability.

Figure 10b shows how the above circuit can be modified so that it can be driven from any type of input waveform,



C1 value	Pulse Width Range
10µF	90 ms – 1.2s
1µF	9 ms – 120ms
0.1µF	0.9 ms – 12 ms
0.01µF	90µs – 1.2 ms
0.001µF	9µs – 120 µs

Fig. 10a: Simple add-on pulse generator is triggered by rectangular input signals: circuit can be used at trigger frequencies up to 100 kHz.

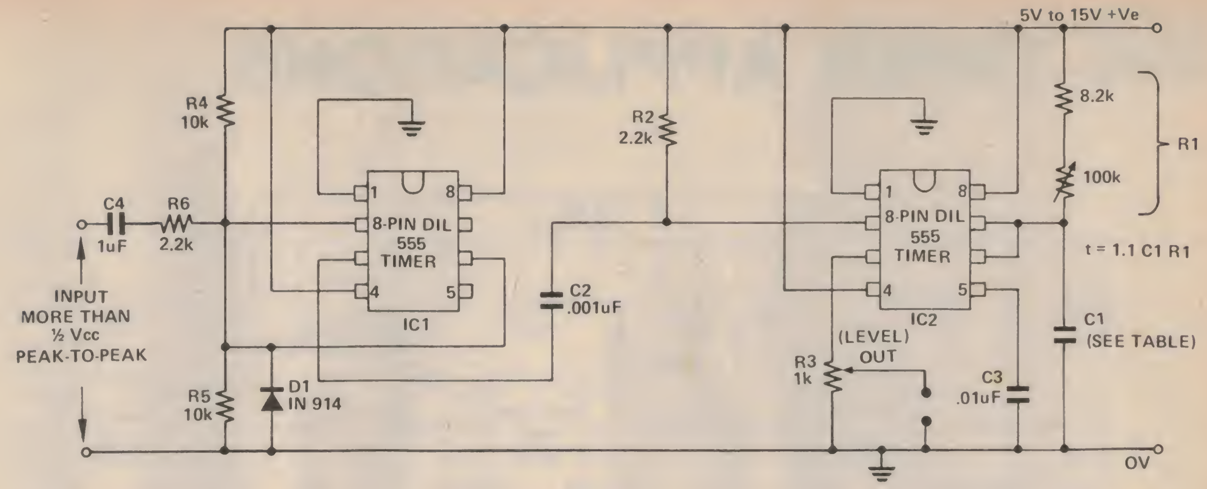


Fig. 10b: Improved add-on pulse generator is triggered by any input waveform.

including sine waves. Here, IC1 is connected as a simple Schmitt trigger, which converts all input signals into rectangular output signals, and these rectangular signals are used to drive the IC2 monostable circuit in the same way as described above The Fig 10b circuit can thus be used as an add-on pulse generator in conjunction with an existing waveform generator of any type that produces output signals with peak-to-peak amplitudes greater than 1/2 Vcc.

Figure 11 shows two basic monostable pulse generators connected in series to make a delayed pulse generator. IC1 is used as a Schmitt trigger and IC2 controls the delay width and IC3 determines the output pulse width: The final output pulse appears some delayed time after the initial application of the trigger signal. This circuit can be made into a self-contained instrument by building it into the same cabinet as a simple square wave generator which can be used to provide the necessary drive signals.

Any number of basic monostable pulse generators can be wired in series to give a sequential form of operation. Figure 12 for example, shows the circuit and wave-forms of a 3-stage sequential generator, which can be used to operate lamps or relays, etc., in a pre-programmed time sequence once an initial START command is given via push-button switch S1. Note that the pin 4 RESET terminal of all ICs are shorted together and positively biased via R7, and that these terminals can be shorted to ground via SET switch S2: This SET switch

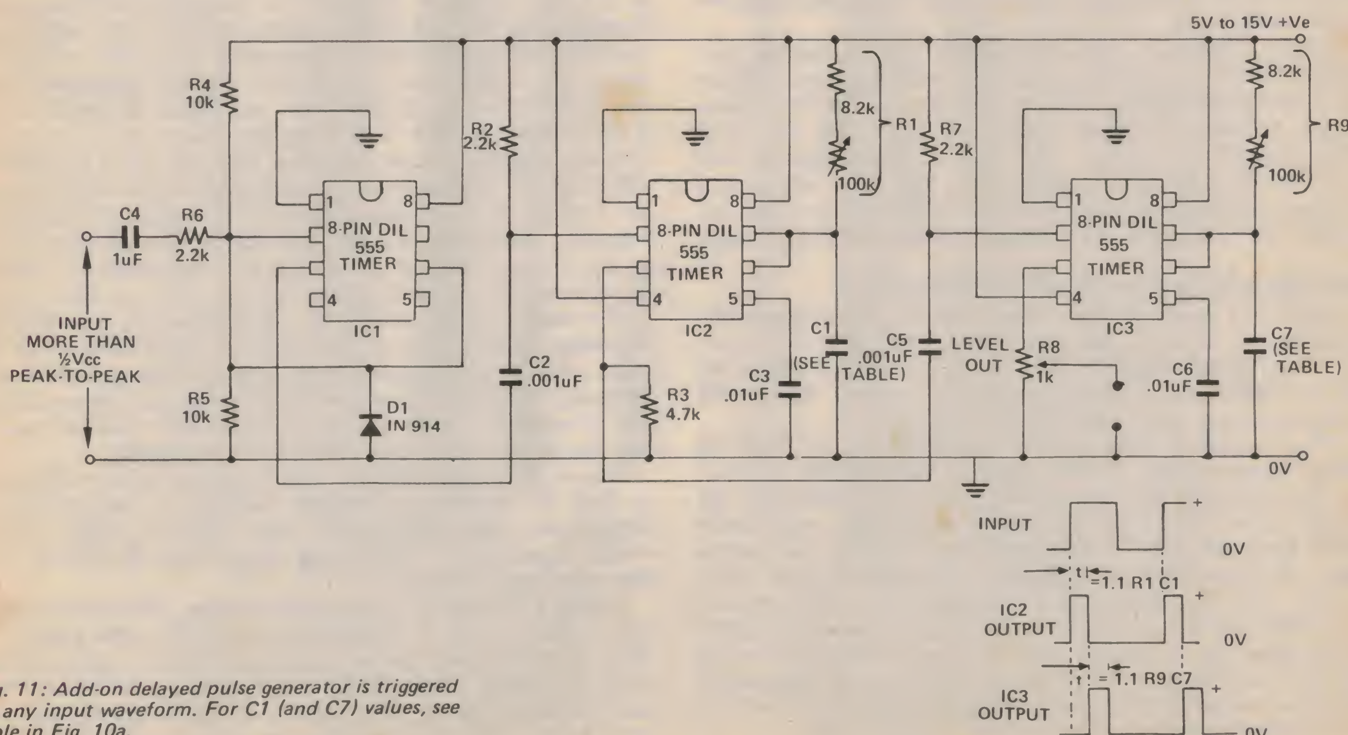


Fig. 11: Add-on delayed pulse generator is triggered by any input waveform. For C1 (and C7) values, see table in Fig. 10a.

555 TIMER APPLICATIONS

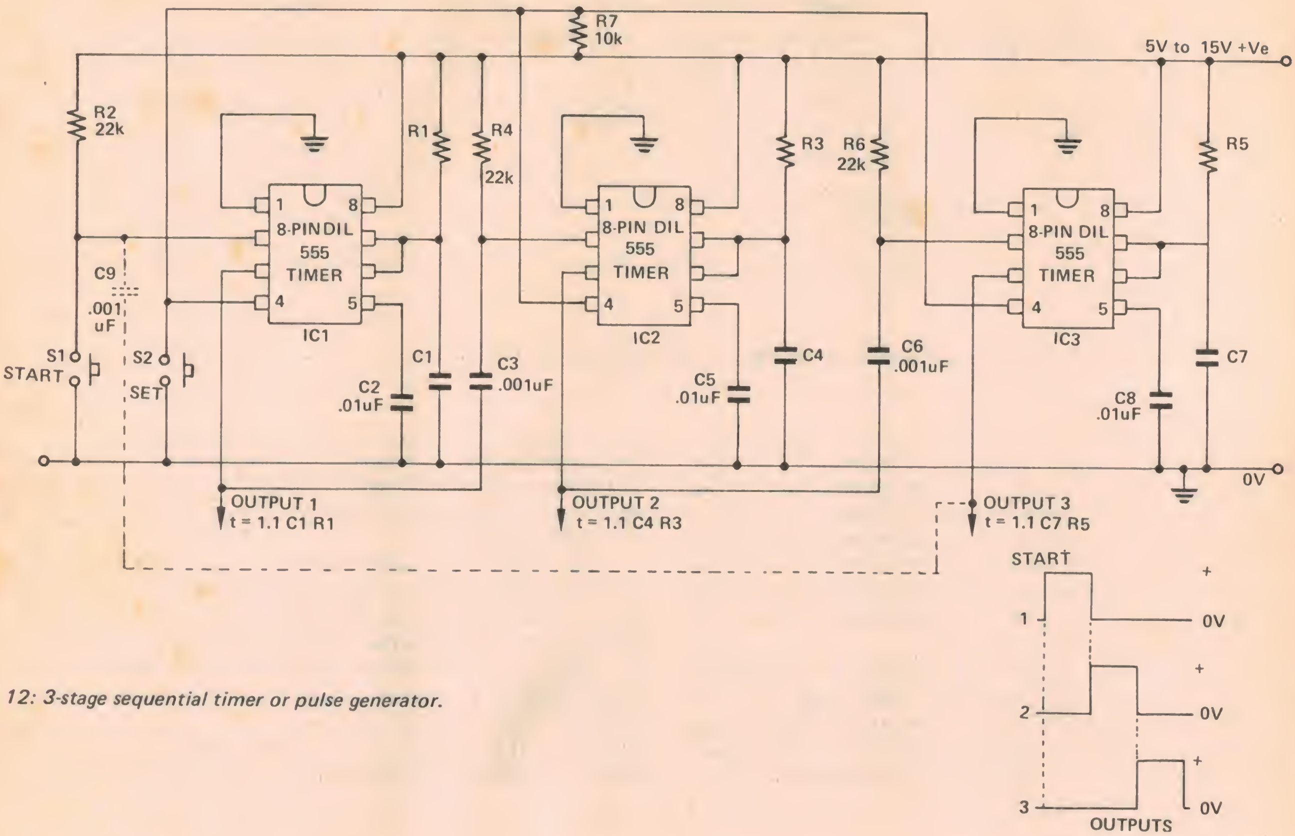


Fig. 12: 3-stage sequential timer or pulse generator.

should be closed at the moment that power is first applied to the circuit, to ensure that none of the ICs falsely triggered at this moment.

Finally, three or more monostable circuits can be connected, via C9, in a continuous loop, with the output of the last monostable feeding back to the input of the first monostable, to form a 'chaser' circuit in which the sequential action repeats to infinity. This type of circuit can be used to drive lamp or LED displays, etc. Note that the circuit is again provided with the S2 SET facility, so that the circuit can be emptied at the moment that power is first applied.

ASTABLE MULTIVIBRATOR CIRCUITS

Figure 13 shows a basic 1kHz astable multivibrator, together with the formulas that define the timing of the circuit. Note that TRIGGER pin 2 of the chip is shorted to the pin 6 THRESHOLD terminal, and that timing resistor R2 is wired between pin 6 and DISCHARGE pin 7.

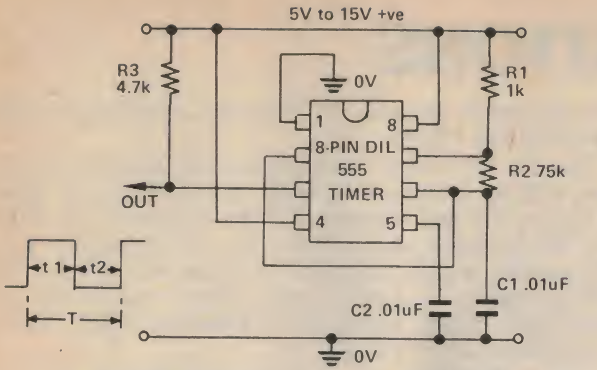
When power is first applied to the circuit C1 starts to charge exponentially (in the normal monostable fashion) via the series R1-R2 combination, until eventually the C1 voltage rises to 2/3 Vcc. At this point the basic monostable action terminates and DISCHARGE pin 7 switches to the low state. C1 then starts to discharge exponentially into pin 7 via R2, until eventually the C1 voltage falls to 1/3 Vcc, and TRIGGER pin 2 is activated. At this point a new monostable timing sequence is initiated, and C1 starts to recharge towards 2/3 Vcc via R1 and R2. The whole sequence then repeats add infinitum, with C1 alternately charging towards 2/3 Vcc via R1-R2 and discharging towards 1/3 Vcc via R2 only.

Note in the above circuit that, if R2 is very large relative to R1, the operating frequency of the circuit is determined essentially by the R2 and C1 values, and that a virtually symmetrical output waveform is generated. The graph of Fig 14 shows the approximate relationship between frequency and the C1-R2 values under the above condition. In practice, the R1-R2 values of the circuit can be varied from 1 kΩ up to tens of megohms. Note, however, that R1 has a significant effect on the total current consumption of the circuit, since pin 7 of the IC is virtually grounded during half of the timing sequence. Also note that the duty cycle or mark/space ratio of the circuit can be pre-set at a non-symmetrical value, if required, by suitable choice of the R1 and R2 values.

The basic circuit of Fig 13 can be usefully modified in a number of ways. Fig 15, for example, shows how it can be made into a variable-frequency square wave generator by replacing R2 with a fixed and variable resistor in series. With the compnenet values shown the frequency can be varied over the approximate range 650 Hz-7.2 kHz via R2.

Figure 16 shows how the circuit can be further modified so that its MARK and SPACE periods are independently variable over the approximate range 7.5μs to 750μs. Here, timing capacitor C1 alternately charges via R1-R2-D1 and discharges via R3-R4-D2.

Figure 17 shows how the circuit can be additionally modified so that it acts as fixed-frequency square wave generator with a mark/space ratio or duty cycle that is fully variable from 1% to 99%. Here, C1 alternately charges via R1 and the top half of R2 and via D1, and discharges via D2-R3 and the lower half of R2. Note that the sum of the two timing periods



t1 = 0.693(R1 + R2)C1
t2 = 0.693(R2)C1
T = 0.693(R1 + 2R2)C1
$f = \frac{1.44}{(R1 + 2R2)C1}$

IF R2 IS GREATER THAN R1:

t1 ≏ 0.7 R2 C1
t2 ≏ 0.7 R2 C1
T ≏ 1.4 R2 C1
$f \simeq \frac{0.72}{R2\,C1}$

Fig. 13: Basic circuit of 1KHz astable multivibrator, with timing formulas.

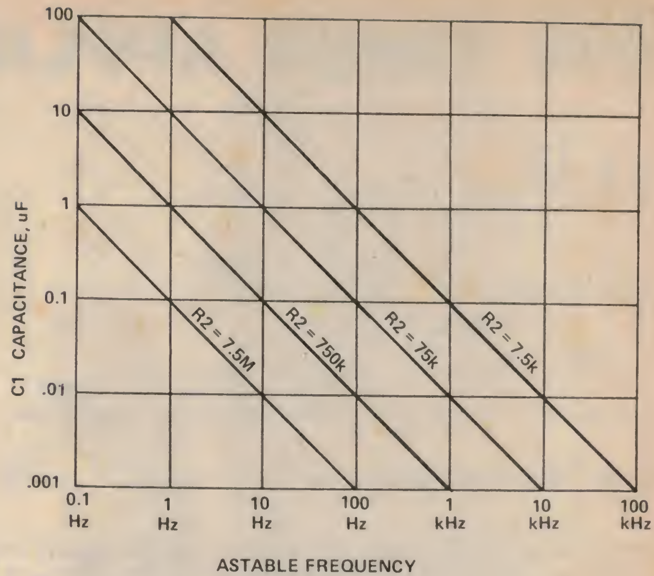


Fig. 14: Approximate relationship between C1, R2, and frequency when R2 is large relative to R1.

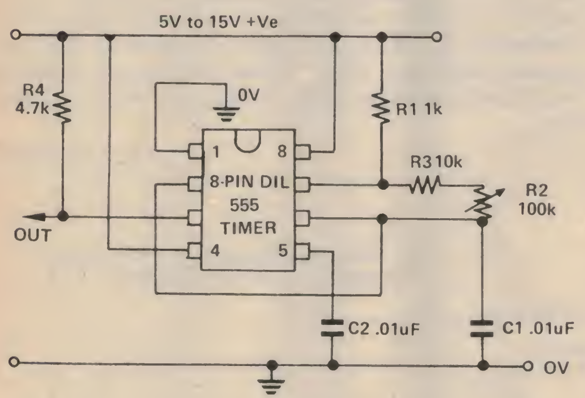


Fig. 15: Variable frequency square wave generator covers the range 650Hz — 7.2 kHz approximately.

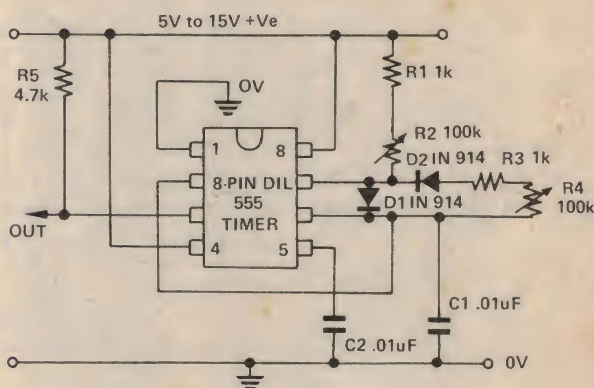


Fig. 16: Astable multi with mark and space periods independently variable over the approximate range 7.5µs to 750µs.

is virtually constant, so the operating frequency is almost independent of the setting of R2.

GATING A 555 ASTABLE

The 555 astable circuit can be gated ON or OFF, via either a switch or an electronic signal, in a variety of ways. Figs 18 and 19 show two basic ways of gating the IC via a switch.

In Fig 18 the circuit is gated via the pin 4 RESET terminal. The characteristic of this terminal is such that, if the terminal is biased significantly above a nominal value of 0.7 volts, the astable is enabled, but if the terminal is biased below 0.7 volts by a current greater than 0.1 mA (by taking the terminal to ground via a resistance less than 7 kΩ, for example) the astable is disabled and its output is grounded. Thus, the Fig 18 circuit is normally on but can be turned off by closing S1 and shorting pin 4 to ground, while the circuit shown in dotted lines is normally gated off via R4 but can be turned on by closing S2 and shorting pin 4 to the positive supply rail. These circuits can alternatively be gated by applying suitable electronic signals directly to pin 4.

The Fig 19a and 19b circuits are gated via the pin 2 TRIGGER and pin 6 THRESHOLD terminals. The characteristic

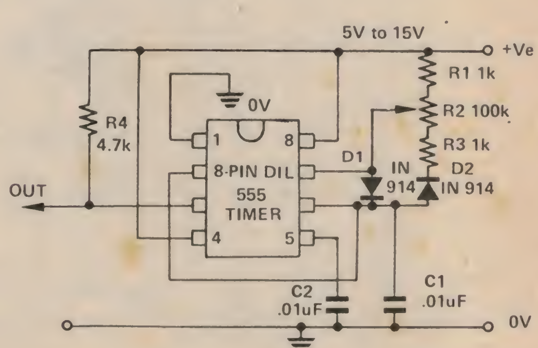


Fig. 17: Astable multi with duty cycle variable from 1 to 99% with frequency approximately constant at 1.2 kHz.

555 TIMER APPLICATIONS

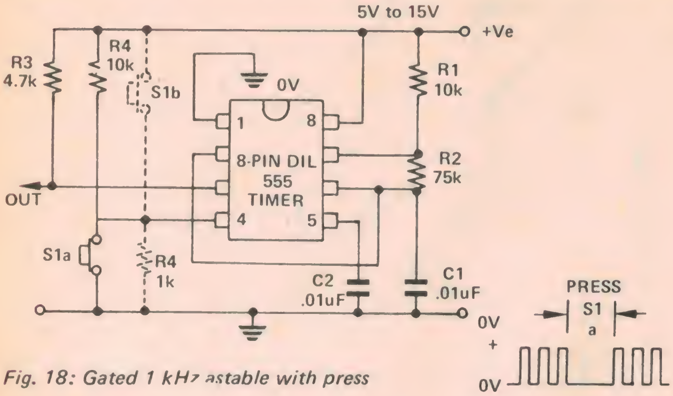


Fig. 18: Gated 1 kHz astable with press

here is such that the circuit functions as a normal astable only as long as pin 6 is free to swing up to 2/3 Vcc and pin 2 is not biased below 1/3 Vcc. If these pins are simultaneously driven below 1/3 Vcc the astable action is immediately terminated and the output is driven to the high state. Thus, the Fig 19a circuit is normally on but turns off when S1 is closed. Note that an electronic signal can be used to gate the circuit by connecting a diode as indicated and eliminating S1. In this case the circuit will gate off when the input signal voltage is reduced below 1/3 Vcc.

The Fig 19b circuit is connected so that it is normally gated off by saturated transistor Q1, but can be gated on by closing S1 and thus turning the transistor off. This circuit can be gated electronically by eliminating R5 and S1 and applying a gating signal to the base of Q1 via a 10 kΩ limiting resistor. In this case the astable turns off when the input signal is high, and turns on when the input signal is reduced below 0.7 volts or so.

All the 555 astable circuits that we have looked at can be subjected to frequency modulation (FM) or pulse-position modulation (PPM) by simply feeding a suitable modulation signal to pin 5. This modulation signal can take the form of an ac signal that is fed to pin 5 via a blocking capacitor, as in the case of Fig 20a or a dc signal that is fed directly to pin 5, as in the case of Fig 20b. The action of the chip is such that the voltage on pin 5 influences the width of the 'mark' pulses in each timing cycle, but has no influence on the 'space' pulses. Thus, since the signal on pin 5 influences the position of each 'mark' pulse in each timing cycle, this terminal provides pulse-position modulation (PPM), and, since the signal influences the total period of each cycle (and thus the frequency of the output signal), the terminal also provides frequency modulation (FM). These facilities are useful in special waveform generator applications, as is shown in the next section.

To be continued . . .

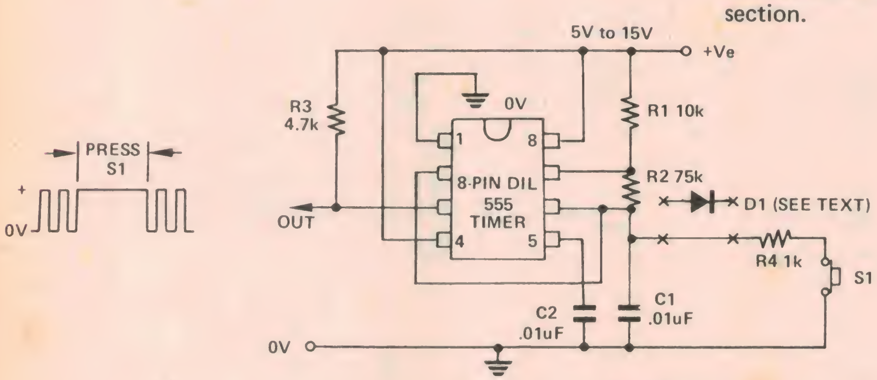


Fig. 19A; Alternative gated 1 kHz astable with 'press to turn-off' operation.

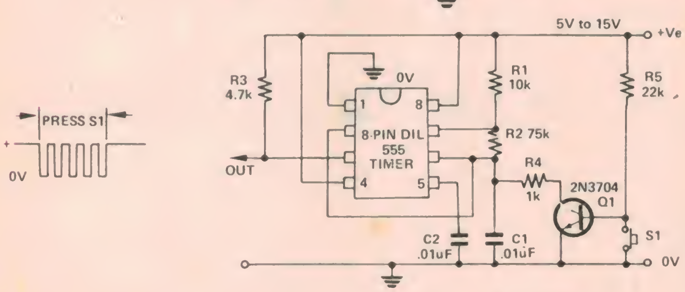
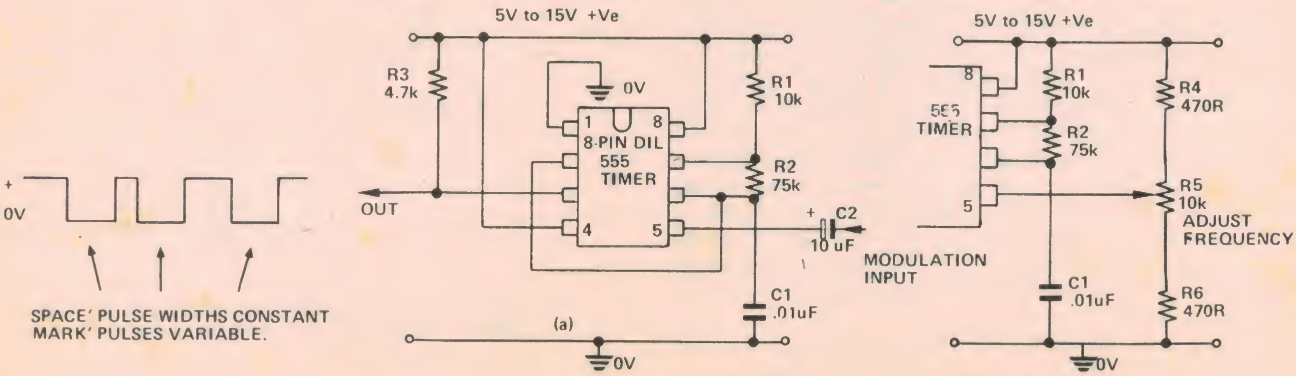


Fig. 19B: Alternative gated 1 kHz astable with 'press to turn-off' operation.

Fig. 20: Alternative ways of obtaining frequency or pulse-position modulation (FM or PPM) from the 555 astable circuit.



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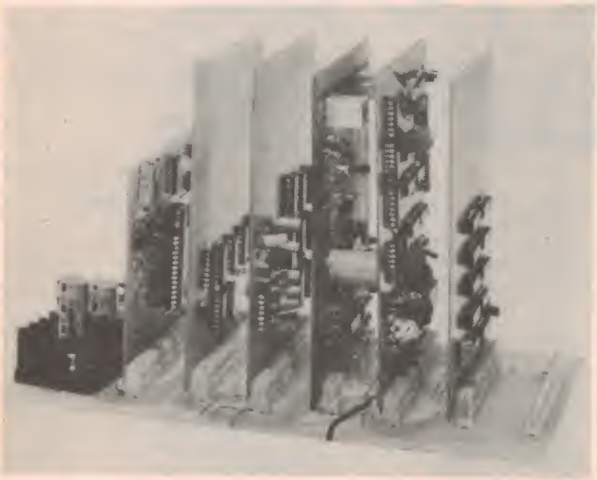

PROJECT 632 VDU

This is an ideal terminal for a home computer system. As described in ETI December to March inclusive, this popular kit can be assembled by anyone with reasonable experience in electronics. We have now added a MODULATOR so that the VDU can be used with any TV set.

PACK	1	632 A,B control logic	$29.50
	2	632 C character generator	$49.50
	3	632 M 1k x 8 memory	$32.50
	4	633 SYNC with modulator	$17.75
	5	632 U UART interface	$21.75
	6	632 MB mother board	$20.00
	7	632 PS power supply	$7.50
	8	Transformer	$8.50

The packs are individually complete including top quality double sided fibreglass boards, molex connectors and all specified components. Please add $2.50 to cover packaging and certified post for one or more packs ordered at the same time.

STOP PRESS: ECONOMY VDU

We now have completed redesigning a slimline version of the 632 which uses two PCB measuring 6" x 14" approx and will easily locate under a keyboard. The 632 SL as it has been designated, consists of the following modules of the 632 632a, b, c, m, u and 633 with modulator. The relevant power rails have been connected to each PCB and the various interconnections are made with direct wire links. This approach results in simplified trouble shooting and substiantially reduces the cost because it eliminates the need for a mother board and the expensive Molex connectors. The kit is supplied complete in every detail including all components, top quality printed circuit boards and full detailed instructions.

AT 632/SL Economy VDU $135.00 (p & p $2.50)

If a power supply is required please see details of the AT512 module on the next page.

TECHNICAL SUPPORT

At Applied Technology we are professional engineers and have had considerable experience with the design and application of microprocessors. We are delighted to offer free technical advice to prospective customers and our extensive service/repair facilities are available should you have trouble getting one of our kits operational.

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SUPER SIMPLE CASSETTE INTERFACE – KANSAS CITY STANDARD

To the hobbyist the key to inexpensive mass storage must be the cassette memory. Using the CT750 you can store up to 90,000 bytes of information on a C-60 audio cassette and you won't lose the info when the power is switched off!

The CT750 is a complete cassette interface based on the so-called "Kansas City" standard which has been adopted by many manufacturers in the USA. We are proud of the simplicity of the design of the CT750 which uses only 4 IC's (including a phase locked loop) to achieve non critical performance with virtually any tape recorder. The CT750 is supplied ASSEMBLED & TESTED and full alignment instructions are included so that you can check the performance of your CT750 at any time.

The CT750 is intended to convert any cassette recorder to a powerful peripheral device for your CPU. It virtually eliminates the need for a paper tape punch/reader. Operation is very simple using the front panel controls and LEDS are provided to indicate the status of the data transfer at any time. The CT750 is ideal for use with 2650 (with PIPBUG routines) and MINI SCAMP with a suitable bootstrap loader program.

CT750 Cassette Interface $39.50
fully assembled, tested (post and packing $2.50).

PERIPHERALS TO PROCESSORS
Mail Order Computer Store

ECONOMY 4K x 8 BASIC RAM

Here is a simple to use, low cost universal RAM module. Does your microprocessor need some more memory? Designated as the SM4000 this RAM is ideal for use with 2650, SC/MP and many other popular processors.

The SM4000 uses a 10" x 5" card size and gold plated 100 pin edge connector compatable with the S100 buss currently proposed as the Australian Standard. The ingenous feature of the design of the SM4000 is that it can be operated on separate data 1/0 bus or bidirectional data lines.

Electrically the SM4000 requires only a single +5V supply. Provision has been made to add on-card regulators if required although these are not supplied with the basic kit. All address lines are fully tristate buffered as are the data input and output lines. Full address decoding is provided so you can locate this memory module at any 4K boundary in your microprocessor memory space. A very useful write protect facility is also provided so you can protect the contents of memory against unwanted erasure.

The SM4000 RAM uses a double sided epoxy glass circuit board with gold plated edge connectors. Top quality low profile sockets are provided for all IC's and all interconnections between the memory IC's are pre-etched ready for soldering. The actual allocation of address, data, control and memory select lines are to be wired according to the specific requirements of the constructor.

The SM4000 is supplied as a complete kit including PCB sockets, 32 prime quality 650ns 2102 RAMS, buffers and logic together with full application details and assembly notes.

SM4000 4K x 8 RAM $99.95 (p & p $2.50)

MINISCAMP — 8
The Affordable, Expandable Microprocessor an ideal Educational Project

Here is a novel approach if you are interested in exploring the exciting world of microprocessors at the lowest possible cost. Introduced in an article in Electronics Australia, April-May 1977, Dr. John Kennewell has designed this project specifically for those who want to start at the basic hardware fundamentals and then progress to the software facits of microprocessors.

To keep within the specified cost goals and to simplify the construction even further we have produced our own special printed board set. The mother board retains all the facilities of the EA design and is laid out on double sided fibreglass logically identical to the schematic diagram so that the student can see the operation at a glance. The front panel control board utilizes top quality PC mounting C & K switches and contains all bus drive logic and LED indicators. The boards are interconnected using computer grade ribbon cable.

The Applied Technology MINISCAMP — 8 is supplied with full documentation including assembly details and SC/MP program instruction set. Our full technical support and warranty service applies (details with each kit).

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POWER SUPPLY COMPONENTS $11.50

NOTE: Special tax exempt prices are available to Educational institutions. Please write for details.

EXPAND YOUR BABY 2650

Now you can easily expand your baby 2650 system to a fully buffered KT9500 or whatever you require. We have been able to purchase the KT9500 PCB (top quality, double sided, plated through holes, silk screened compound overlay, solder resist!) and are pleased to make it available to our customers approximately mid May. Using this well designed board you can develop your own 2650 system to any level you require. The board plugs into a 100 pin wire wrap socket (yes S100 type!) and is supplied with suggested schematic diagrams and parts list.

BABY 2650 EXPANSION KIT including PCB, edge connector, documentation package $45.00.

SPECIAL OFFER N CHANNEL SCMP CHIP $16.75 WITH DATA

This new device has just been released. It uses single +5V power, draws less current yet runs twice as fast as the standard SC/MP. This is an ideal opportunity to upgrade your present SC/MP system or just experiment with a real live microprocessor!

SC/MP II N CHANNEL $16.75 (post free)

AT 512 POWER SUPPLY KIT

Here is a neat little power supply capable of delivering +5V at 1A and -12V at 500mA. It is ideal for powering microprocessor evaluation kits such as SC/MP INTROKIT or BABY 2650.

Housed in an attractive PC1 box the AT512 features front panel output terminals, mains switch and LED power indicator. It is supplied complete with all components and full detailed instructions.

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AT512 ASSEMBLED & TESTED $29.50

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20 pin strip	1.20	1.15

KYNAR WIRE 50' SPOOLS $2.95
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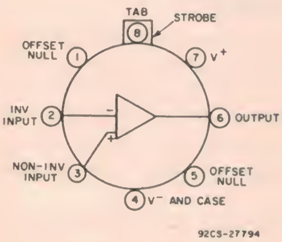
Hand Tool $7.80

ETI data sheet

CA 3140 operational amplifier



. *Fig.1 — Functional diagram of CA3140 series.*

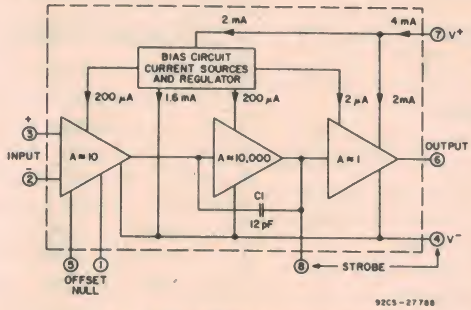


Fig.2 — Block diagram of CA3140 series.

TYPICAL ELECTRICAL CHARACTERISTICS

CHARACTERISTIC		TEST CONDITIONS $V^+ = +15$ V $V^- = -15$ V $T_A = 25^oC$	UNITS	
Input Resistance	R1		1.5	TΩ
Input Capacitance	C1		4	pF
Output Resistance	RO		60	Ω
Equivalent Wideband Input Noise Voltage	en	BW = 140 kHz R_S = 1 MΩ	48	µV
Equivalent Input Noise Voltage	e_n	f = 1 kHz R_S =	40	
		f = 10 kHz 100Ω	12	
Short-Circuit Current to Opposite Supply Source	10M+		40	mA
Sink	10M−		18	mA
Gain-Bandwidth Product 8	f_T		4.5	MHz
Slew Rate	SR		9	V/µs
Sink Current From Terminal 8 To Terminal 4 to Swing Output Low	8		220	µA
Transient Response: Rise Time 8	t_r	R_L = 2kΩ	0.08	µs
Overshoot		C_L = 100 pF	10	%
Settling Time at 10 Vpp 1 mV		R_L = 2kΩ	4.5	
10 mV	t_s	C_L = 100 pF Voltage Follower	1.4	µs

MAXIMUM RATINGS, Absolute-Maximum Values.

DC SUPPLY VOLTAGE
(BETWEEN V+ AND V- TERMINALS) . . . . .36 V
DIFFERENTIAL-MODE INPUT VOLTAGE . . . . ±8 V
COMMON-MODE DC INPUT VOLTAGE . . . . (V+ +8V) to (V- -0.5V)
INPUT-TERMINAL CURRENT . . . . 1 mA
DEVICE DISSIPATION:
WITHOUT HEAT SINK –
UP TO 55°C. . . . . .630 mW
ABOVE 55°C . . . . Derate linearly 6.67 mW/°C
WITH HEAT SINK –
Up to 55°C . . . . 1 W
Above 55°C . . . . Derate linearly 16.7 mW/°C
OUTPUT SHORT-CIRCUIT DURATION . . . . .INDEFINITE

Short circuit may be applied to ground or to either supply.

The CA3140B, CA3140A, and CA3140 are integrated-circuit operational amplifiers that combine the advantages of high-voltage PMOS transistors with high-voltage bipolar transistors on a single monolithic chip. Because of this unique combination of technologies, this device can now provide designers, for the first time, with the special performance features of the CA3130 COS/MOS operational amplifiers and the versatility of the 741 series of industry-standard operational amplifiers.

The CA3140,CA3140A , and CA3140 BiMOS operational amplifiers feature gate-protected MOS/FET (PMOS) transistors in the input circuit to provide very-high-input impedance, very-low-input current, and high-speed performance. The CA3140B operates at supply voltages from 4 to 44 volts; the CA3140A and CA3140 from 4 to 36 volts (either single or dual supply). These operational amplifiers are internally phase-compensated to achieve stable operation in unity-gain follower operation, and, additionally, have access terminals for a supplementary external capacitor if additional frequency roll-off is desired. Terminals are also provided for use in applications requiring input offset-voltage nulling.

The use of PMOS field-effect transistors in the input stage results in common-mode input-voltage capability down to 0.5 volt below the negative-supply terminal, an important attribute for single-supply applications. The output stage uses bipolar transistors and includes built-in protection against damage from load-terminal short-circuiting to either supply-rail or to ground.

The CA3140 Series has the same 8-lead terminal pin-out used for the "741" and other industry-standard operational amplifiers.They are supplied in either the standard 8-lead TO-5 style package (T suffix), or in the 8-lead dual-in-line formed-lead TO-5 style package "DIL-CAN" (S suffix). The CA3140B is intended for operation at supply voltages ranging from 4 to 44 volts, for applications requiring premium-grade specifications and with electrical limits established for operation over the range from −55°C to + 125°C. The CA3140A and CA3140 are for operation at supply voltages up to 36 volts (±18 volts). The CA3140 and CA3140A can also be operated safely over the temperature range from −55°C to + 125°C, although specification limits for their electrical parameters do not apply when they are operated beyond their specified temperature ranges.

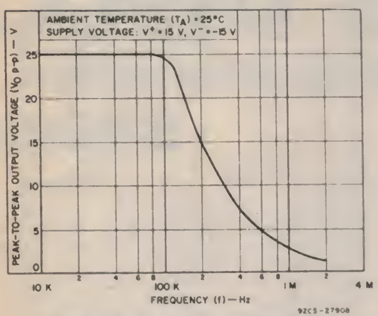


Fig.8 — Maximum output voltage swing vs frequency.

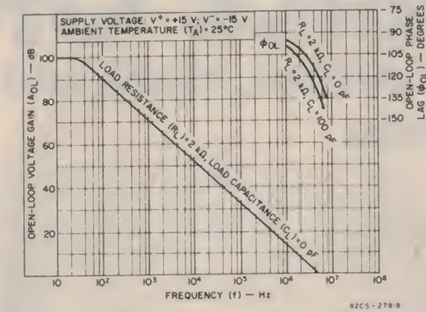


Fig.18 — Open-loop voltage gain and phase lag vs frequency.

ELECTRICAL CHARACTERISTICS FOR EQUIPMENT DESIGN
At V^+ = 15 V, V^- = 15 V, T_A = 25°C Unless Otherwise Specified

CHARACTERISTIC	Min.	Typ.	Max.	UNITS
Input Offset Voltage, V10	—	5	15	mV
Input Offset Current I_{10}	—	0.5	30	pA
Input Current I_I	—	10	50	pA
Large-Signal Voltage Gain, A_{OL}*	86	100	—	dB
Common-Mode Rejection Ratio, CMRR	70	90	—	dB
Common-Mode Input-Voltage Range, V_{ICR}	−15	−15.5 to +12.5	11	V
At V^+ = 5 V, V^- = 0 V,	−0.5 to +2.6			V
Power Supply Rejection Ratio, PSRR (see Fig. 11)	76	80	—	dB
Max. Output Voltage ■	V_{OM+}	+12	13	—
	V_{OM-}	−14	−14.4	—
Supply Current, I^t	—	4	6	mA
Device Dissipation, P_D	—	120	180	mW

★ At V_O = 26V_{p-p}, +12V, −14V and R_L = 2kΩ

■ At R_L = 2kΩ

DRIVING TTL

Excellent interfacing with TTL circuitry is easily achieved with a single 6.2-volt zener diode connected to terminal 8 as shown in Fig 5. This connection assures that the maximum output signal swing will not go more positive than the zener voltage minus two base-to-emitter voltage drops within the CA3140.

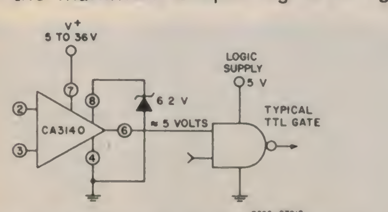


Fig.5. Zener clamping diode connected to terminals 8 and 4 to limit the CA3140 output swing to TTL levels.

OFFSET-VOLTAGE NULLING

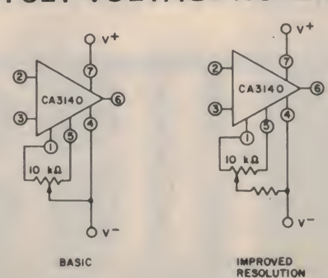


Fig.6. Two offset-voltage nulling methods.

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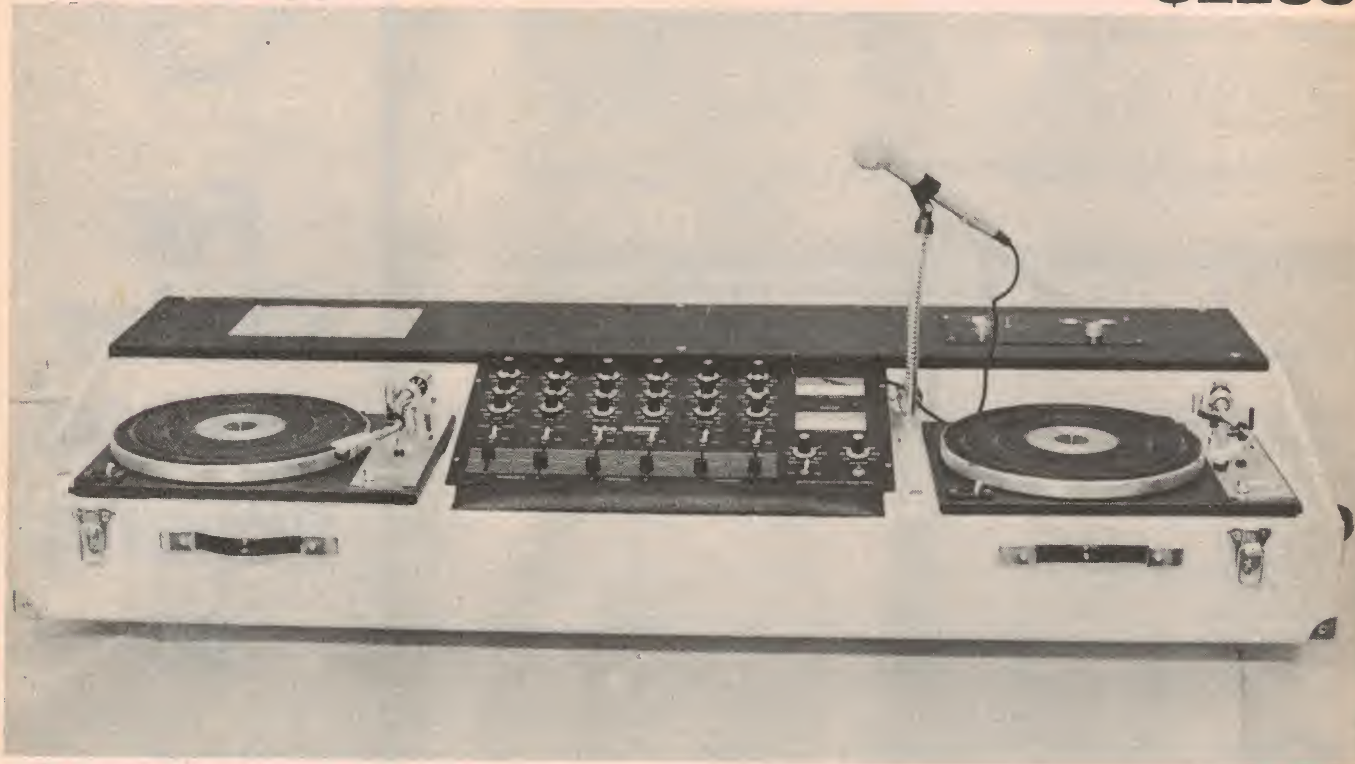

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ETI data sheet

CA 3140 operational amplifier cont'

INPUT CIRCUIT CONSIDERATIONS

As mentioned previously, the amplifier inputs can be driven below the terminal 4 potential, but a series current-limiting resistor is recommended to limit the maximum input terminal current to less than 1 mA to prevent damage to the input protection circuitry.

Moreover, some current-limiting resistance should be provided between the inverting input and the output when the CA3140 is used as a unity-gain voltage follower. This resistance prevents the possibility of extremely large input-signal transients from forcing a signal through the input-protection network and directly driving the internal constant-current source which could result in positive feedback via the output terminal. A 3.9-kΩ resistor is sufficient.

The typical input current is in the order of 10 pA when the inputs are centered at nominal device dissipation. As the output supplies load current, device dissipation will increase, raising the chip temperature and resulting in increased input current.

TONE CONTROL CIRCUITS

High-slew-rate, wide-bandwidth, high-output voltage capability and high input impedance are all characteristics required of tone-control amplifiers. Two tone control circuits that exploit these characteristics of the CA3140 are shown in Figs 7 and 8.

The first circuit, shown in Fig 7, is the Baxandall tone-control circuit which provides unity gain at midband and uses standard linear potentiometers. The high input impedance of the CA3140 makes possible the use of low-cost, low-value, small-size capacitors, as well as reduced load of the driving stage.

Bass treble boost and cut are ±15 dB at 100 Hz and 10 kHz, respectively. Full peak-to-peak output is available up to at least 20 kHz due to the high slew rate of the CA3140. The amplifier gain is -3 dB down from its "flat" position at 70 kHz.

Fig 8 shows another tone-control circuit with similar boost and cut specifications. The wideband gain of this circuit is equal to the ultimate boost or cut plus one, which in this case is a gain of eleven. For 20-dB boost and cut, the input loading of this circuit is essentially equal to the value of the resistance from terminal No. 3 to ground. A detailed analysis of this circuit is given in "An IC Operational Transconductance Amplifier (OTA) With Power Capability" by L, Kaplan and H. Wittlinger, IEEE Transactions on Broadcast and Television Receivers, Vol. BTR-18, No. 3, August, 1972.

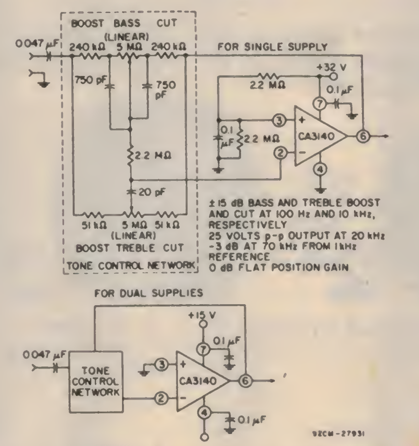

Fig. 7 — Baxandall tone control circuit using CA 3140 series.

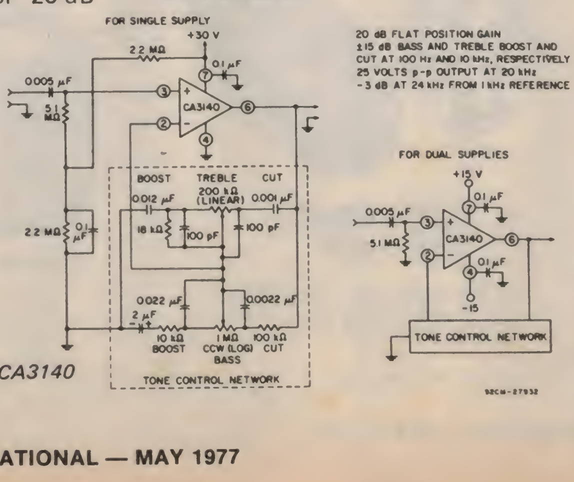

Fig. 8 — Tone control circuit using CA3140 series (20-dB midband gain).

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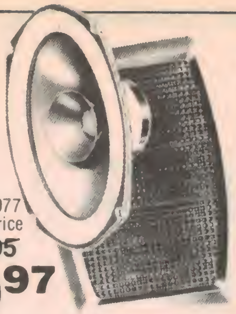

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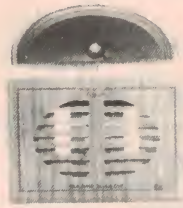

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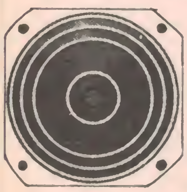

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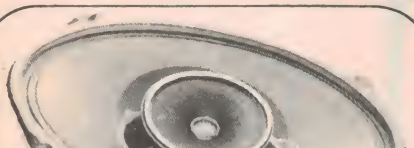

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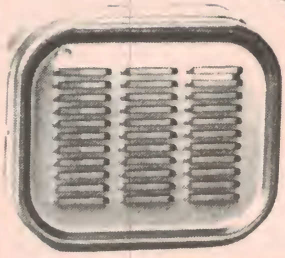

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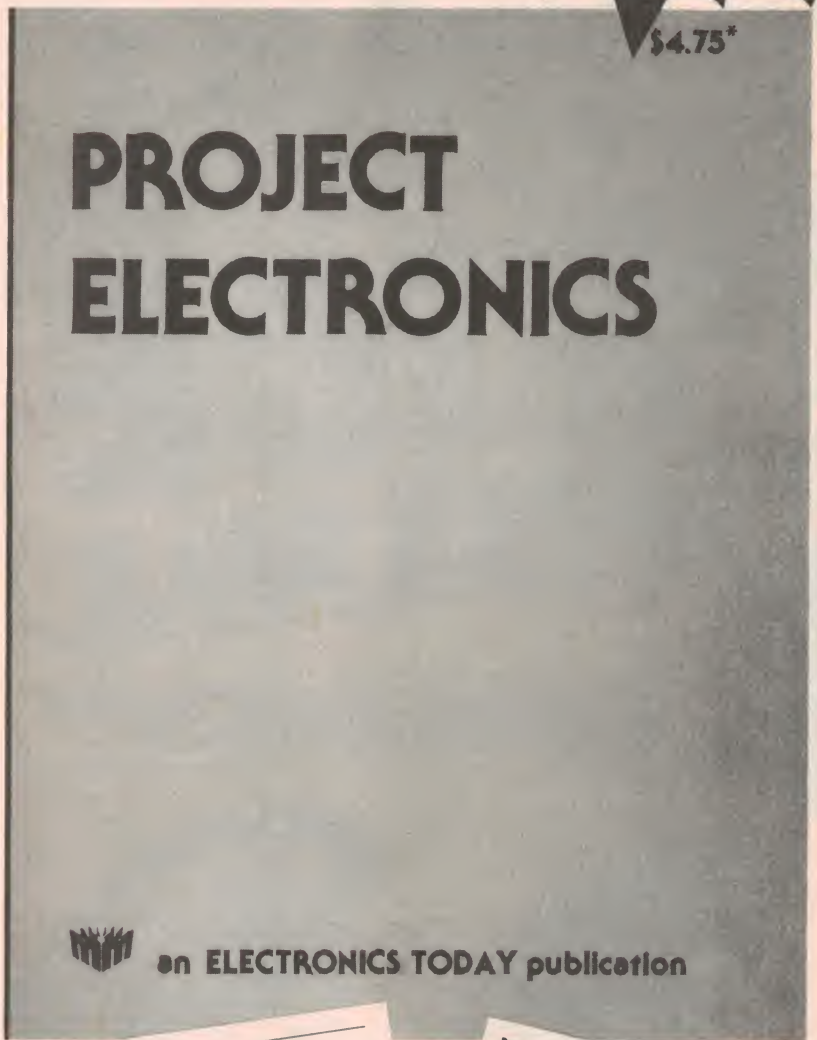

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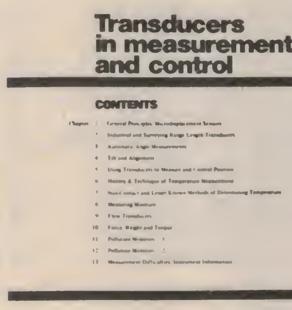

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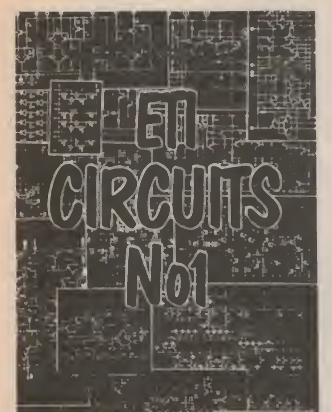

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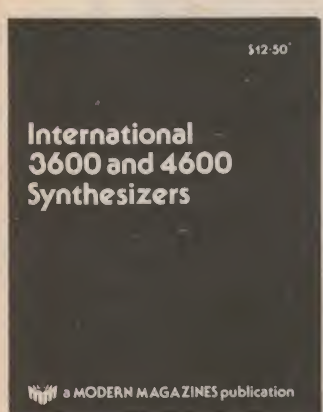

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ETI 111	IC Power Supply	E
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ETI 116	Impedance Meter	E
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ETI 440	Simple 25 Watt Amp	L,E
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INDUCTION BALANCE METAL DETECTOR

A really sensitive design operating on a different principle from that of other published circuits. This 'Induction Balance' metal locator will really sniff out those buried coins and other items of interest at great depths (depending on the size of the object).

"ANOTHER METAL LOCATOR," some of you will say. Yes and no. Several designs have been published in hobby electronics magazines around the world, some good, some downright lousy, but they have invariably been Beat Frequency Oscillator (BFO) types. There's nothing wrong with this principle — they are at least easy to build and simple to set up. The design described here works on a very different principle, that of induction balance (IB). This is also known as the TR principle (Transmit-Receive).

First a word of warning. The electronic circuitry of this project is straightforward and should present no difficulty even to the beginner. However, successful operation depends almost entirely upon the construction of the search head and its coils. This part should account for about three-quarters of the effort in construction. Great care, neatness and patience is necessary and a sensitive 'scope, though not absolutely essential, is very useful. It has to be stated categorically that sloppy construction of the coil will (not may) invalidate the entire operation.

IB Versus BFO

The usual circuit for a metal locator is shown in Fig. 2a. A search coil, usually 6in or so in diameter is connected in the circuit to oscillate at between 100 and 150 kHz. A second internal oscillator operating on the same frequency is included and a tiny part of each signal is taken to a mixer and a beat note is produced. When the search coil is brought near metal, the inductance of the coil is changed slightly, altering the frequency and thus the tone of the note. A tone is produced continually when the instrument is in use and metal is identified by a frequency change in the audio tone.

The IB principle, however, uses two coils arranged in such a way that there is virtually no inductive pick-up between them. A modulated signal is fed into one. When metal is brought near, the electromagnetic field is disturbed and the other coil picks up an appreciably higher signal.

Ideally the instrument is initially set up for no pick-up in the 'receiver' coil, but this is impossible in practice — the two coils are after all laid on top of each other. Another problem is that our ears are poor at identifying changes in audio level. The circuit is therefore arranged so that the signal is gated and is set up so that only the minutest part of the signal is heard when no metal is present. When the coils are near metal, a minute change in level becomes an enormous change in volume.

BFO detectors are not as sensitive as IB types and have to be fitted with a Faraday screen (beware of those which aren't — they're practically useless) to reduce capacitive effects on the coil. They are however, slightly better than IB types when it comes to pin-pointing exactly where the metal is buried.

Our detector is extremely sensitive — in fact a bit too sensitive for some applications! For this reason we've included a high-low sensitivity switch.

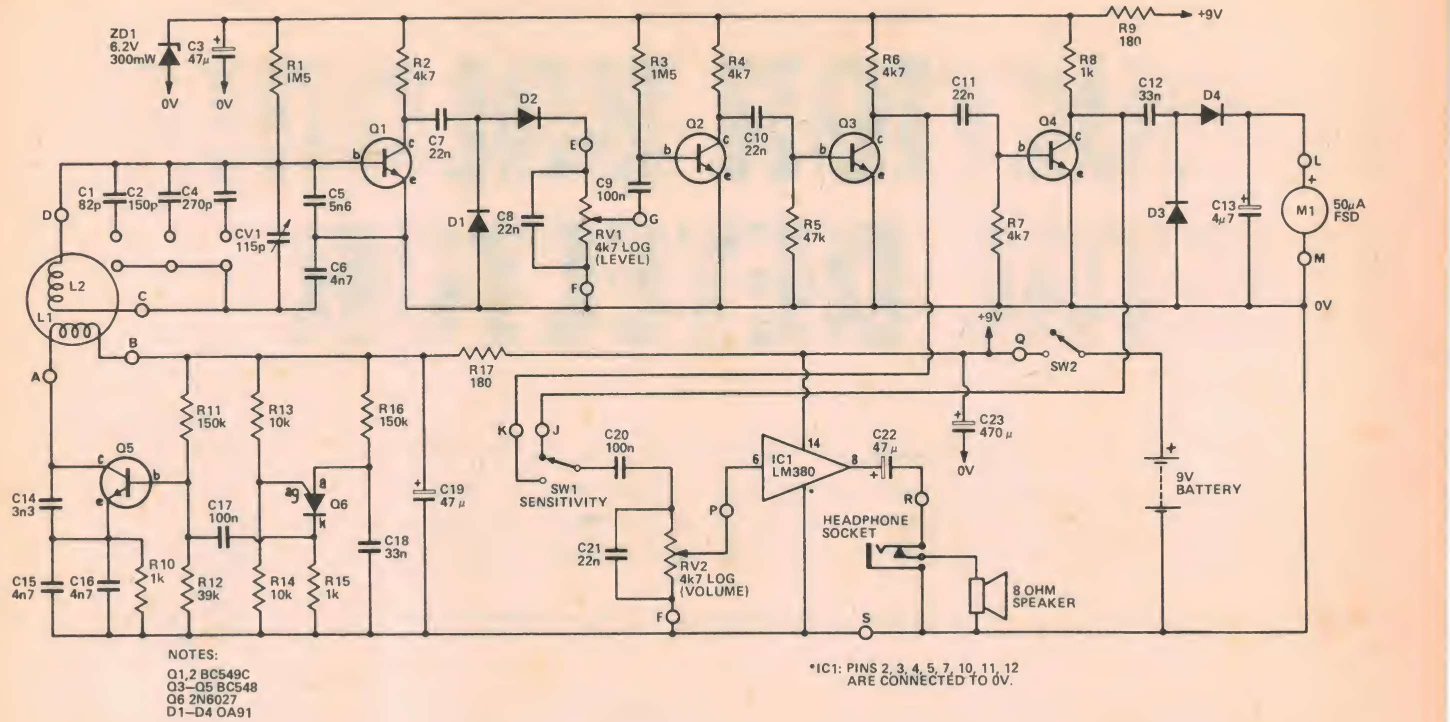


Fig. 1. Complete circuit of the metal locator. Note that though the electronics is simple using very common parts, the whole operation depends on the coil L1 and L2 which must be arranged so that there is minimal inductive coupling between the two. Note also that the leads from the circuit board to the search head must be individually screened and earthed at PCB.

You may ask why low sensitivity is useful. As a crude example, take a coin lying on a wooden floor: on maximum sensitivity the detector will pick up the nails, etc., and give the same readings as for the coin, making it difficult to find.

Treasure hunting is an art and the dual sensitivity may only be appreciated after trials.

Table 1 gives the distances at which various objects can be detected. These are static readings and only give an indication of range. If you are unimpressed with this performance you should bear two things in mind: first compare this with any other claims (ours are excellent and honest) and secondly bear in mind how difficult it is to dig a hole over 1ft of ground every time you get a reading. Try it — it's hard work!

Component Choice

We have specified Q1 and Q2 types as BC549C (highest gain group) for although lower gain transistors worked for us, they left little reserve of level on RV1 and really low gain types may not work at all.

RV1 is the critical control and should be a high quality type — it will be found that it has to be set very carefully for proper operation.

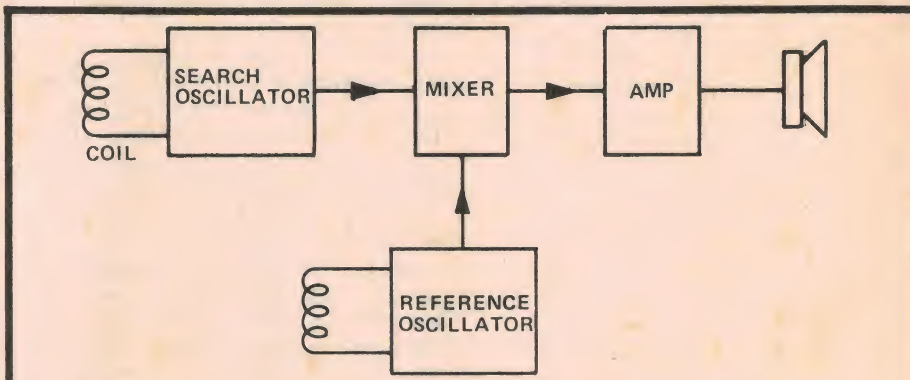


Fig. 2a. Block diagram of the common BFO type metal locator.

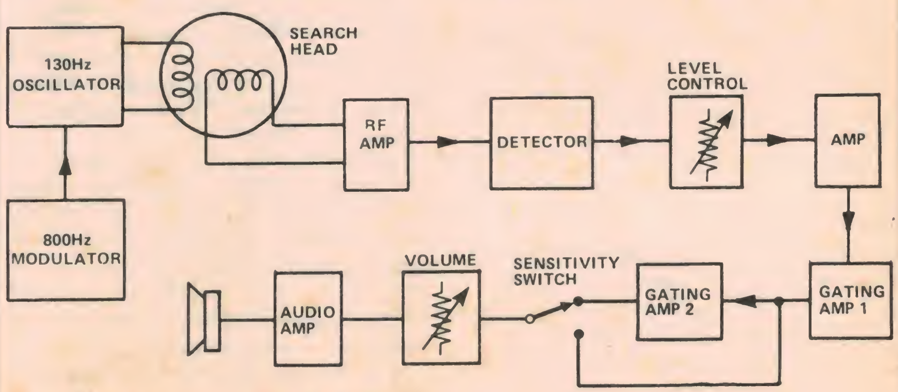


Fig. 2b. Block diagram of our IB design.

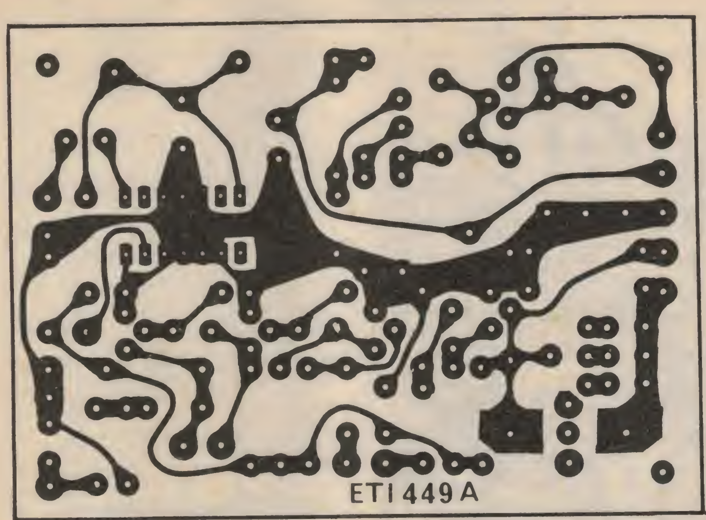


Fig. 3. Printed circuit layout. Full size 90 x 65 mm.

How It Works – ETI 549

Q5, Q6 and associated components form the transmitter section of the circuit. Q6 is a P.U.T. which operates as a relaxation oscillator, the audio note produced being determined by R16 and C18. The specified components give a tone of roughly 800 Hz.

Q5 is connected as Colpitt's oscillator working at a nominal 130 kHz; this signal is heavily modulated by C17 feeding to the base of Q5. In fact the oscillator produces bursts of r.f. at 800 Hz. L1 in the search head is the transmitter coil.

L2 is arranged in the search head in such a way that the minimum possible signal from L1 is induced into it (but see notes on setting up). On all the prototypes we made we reduced this to about 20 mV peak-to-peak in L2. L2 is tuned by C5 and C6 and peaked by CV1 and feeds to the base of Q1, a high gain amplifier. This signal (which is still modulated r.f.) is detected by D1, and D2. The r.f. is eliminated by C8 and connects to the level control RV1.

The signal is amplified by Q2 and then further amplified by Q3 which has no d.c. bias connected to the base. In no-signal conditions this will be turned off totally and will only conduct when the peaks of the 800 Hz exceed about 0.6V across R5. Only the signal above this level is amplified.

On low sensitivity these peaks are connected to the volume control RV2 (any stray r.f. or very sharp peaks being smoothed by C21) and fed to the IC amplifier and so to the speaker.

The high sensitivity stage Q4 is connected at all times and introduces another gating stage serving the same purpose as the earlier stage of Q3. This emphasises the change in level in L2 even more dramatically. Note that RV1 has to be set differently for high and low sensitivity settings of SW1.

Whichever setting is chosen for SW1. RV1 is set so that a signal can just be heard. In practice it will be found that between no-signal and moderate-signal there is a setting for RV1 where a 'crackle' can be heard. Odd peaks of the 800 Hz find their way through but they do not come through as a tone. This is the correct setting for RV1.

The stage Q4 also feeds the meter circuit. Due to the nature of the pulses this need only be very simple.

Since we are detecting really minute changes in level it is important that the supply voltage in the early stages of the receiver are stabilised, for this reason ZD1 is included to hold the supply steady independent of battery voltage (which will fall on high output due to the current drawn by IC1).

It is also important that the supply voltage to Q5 and Q6 does not feed any singal through to the receiver. If trouble is experienced (we didn't get any) a separate 9V battery could be used to supply this stage.

IC1 is being well underused so a heatsink is unnecessary.

Battery consumption is fairly high on signal conditions – between 60 mA and 80 mA on various prototypes but this will only be for very short periods and is thus acceptable. A more modest 20 mA or so is normal at the 'crackling' setting.

Stereo headphones are used and are connected in series to present 16 ohms to IC1 reducing current consumption.

The choice of an LM380 may seem surprising as only a small part of its power can be utilised with battery operation. It is however inexpensive and widely available unlike the alternatives (note it does not require dc blocking at the input).

Output is connected for an 8 ohm speaker and to headphones. Stereo types are the most common and the wiring of the jack socket is such that the two sections are connected in series presenting a 16 ohm load (this reduces current consumption from the battery).

Construction: Control Box

The majority of the components are mounted on the PCB overlay and the additional wiring is shown in Fig. 4.

Exceptional care should be taken to mount all components firmly to the board. Poor connections or dubious solder joints may be acceptable in some circuits – not in this one. Take care to mount the transistors, diodes and electrolytic capacitors the right way around.

The PCB is fitted into the control box by means of 6 mm spacers. The control box has to be drilled to take th speaker, the pots, switches, headphone jack and the cable from the search head.

The Handle Assembly

The handle we used was simply a broom handle with the end cut off at about 45°. After assembling the head, the handle can be glued on with epoxy. A small woodscrew can be used to hold it in place until dry. This should be done before final setting up of the coils – in case the screw cannot be removed after the glue has set.

The Coil

Remember this is the key to the whole operation. The casing of the coil is not so critical but the layout is.

It is best first to make the 6 mm plywood circle to the dimensions shown in Fig.6. A circle of thinner plywood or hardboard is then firmly glued onto this – it's fairly easy to cut this after glueing. Use good quality ply and a modern wood glue to make this.

This now forms a dish into which the coils are fitted.

You'll now have to find something cylindrical with a diameter of near enough 140 mm (5½in). A coil will then have to be made of 40 turns of 32 swg enamelled copper wire. The wire should be wound close together and kept well bunched and taped to keep it together when removed from the

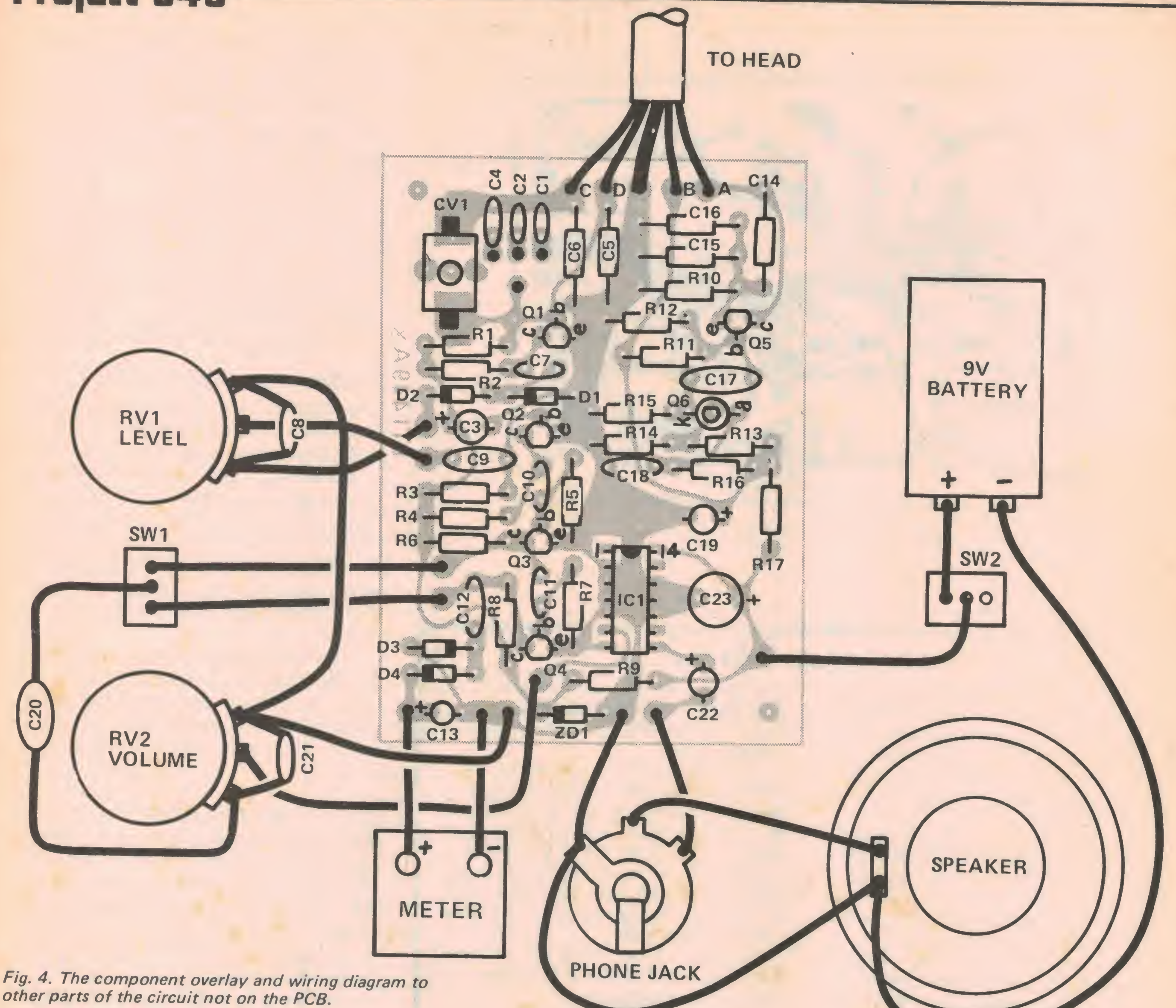


Fig. 4. The component overlay and wiring diagram to other parts of the circuit not on the PCB.

former. Two such coils are required. These are identical.

One of the coils is then fitted into the dish and spot glued in six or eight places using quick setting epoxy resin: see photograph.

L2 is then fitted into place, again spot glueing (*not* in the area that it overlaps L1). The cable connecting the coil to the circuit is then fed through a hole drilled in the dish and connected to the four ends. These should be directly wired and glued in place, obviously taking care that they don't short. The cable must be a four-wire type with individual screens — the screens are left unconnected at the search head.

You will now need the built up control box and preferably a 'scope. The transmit circuit is connected to L1. The signal induced into L2 is monitored; at first this may be very high but my manipulating L2 the level will be seen to fall to a very low level. When a very low level is reached, spot glue L2 until only a small part is left for bending.

Ensure that when you are doing this that you are as far away from any metal as possible but that any metal used to mount the handle to the head is in place. Small amounts of metal are acceptable as long as they are taken into account whilst setting up.

Now connect up the remainder of the circuit and set RV1 so that it is *just* passing through a signal to the speaker. Bring a piece of metal near the coil and the signal should rise. If it falls in level (i.e. the crackling disappears) the coil has to be adjusted until metal brings about a rise with no initial falling. CV1 should be adjusted for maximum signal, this has to be done in conjunction with RV1. The additional capacitors C1, C2 and C4 should be linked in, if the range is not available on CV1.

Monitoring this on a scope may mean that the induced signal is not at its absolute minimum: this doesn't matter too much. Now add more spot gluing points to L2.

You should now try the metal locator in operation. If RV1 is being operated entirely at the lower end of its track, making setting difficult, you can select a lower gain transistor such as a BC548 for Q2.

When you are quite certain that no more manipulation of the coils will improve the performance, mix up plenty of epoxy resin and smother both coils, making certain that you don't move

PARTS LIST — ETI 549

Resistors	all ½ W 5%
R1	1M5
R2	4k7
R3	1M5
R4	4k7
R5	47 k
R6,7	4k7
R8	1 k
R9	180 ohms
R10	1 k
R11	150 k
R12	39 k
R13,14	10 k
R15	1 k
R16	150 k
R17	180 ohms
Potentiometers	
RV1,2	rotary 4k7 log

Capacitors	
C1	82 p ceramic
C2	150 p ceramic
C3	47 µ 10 V electro
C4	270 p ceramic
C5	5n6 polystyrene*
C6	4n7 polystyrene*
C7,8	22 n polyester
C9	100 n polyester
C10,11	22 n polyester
C12	33 n polyester
C13	4µ7 25 V electro
C14	3n3 polystyrene *
C15,16	4n7 polystyrene *
C17	100 n polyester
C18	33 n polyester
C19	47 µ 10 V electro
C20	100 n polyester
C21	22 n polyester
C22	47 µ 10 V electro
C23	470 µ 16 V electro
CV1	115 p variable

* Philips 424 series recommended.

Semiconductors	
Q1,2	Transistors BC549C
Q3-Q5	Transistors BC548
Q6	PUT 2N6027
D1-D4	Diodes OA91, OA95
IC1	Amplifier LM 380
ZD1	Zener 6.2 V 300 mW

Miscellaneous
PC board ETI 549 A
Meter 50 µA FSD
Search head as per Fig. 6.
Two changeover slide switches.
Two knobs
Suitable case (158 x 95 x 50 mm)
Phone socket
Small speaker
9 V battery clip
Six by AA battery holder
Six AA batteries.

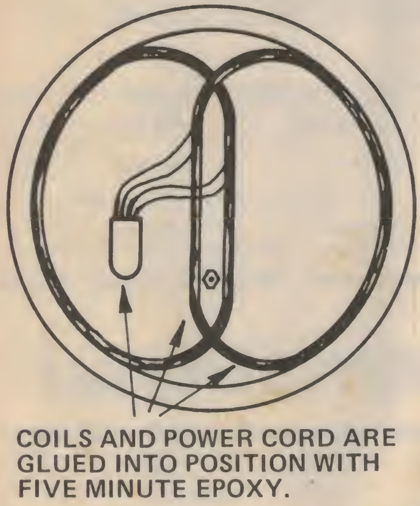
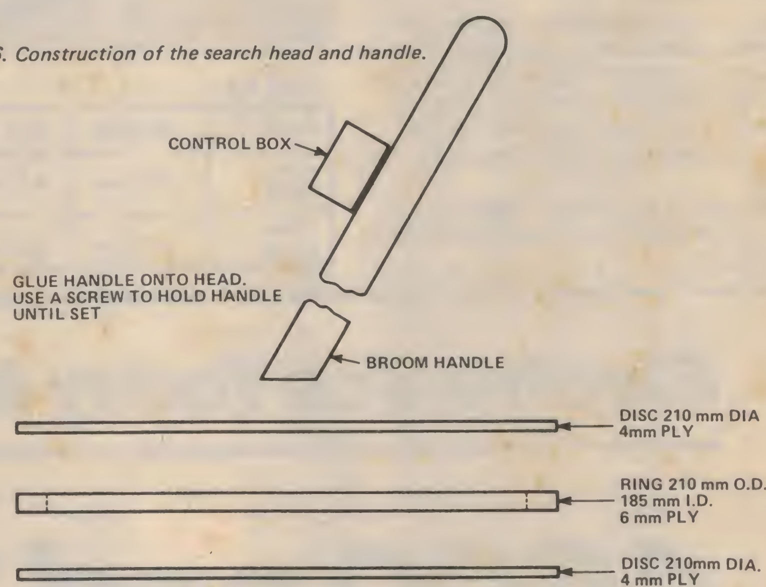


Fig. 5. Diagram showing the position of the coils in the search head.

Fig. 6. Construction of the search head and handle.



them relative to each other.

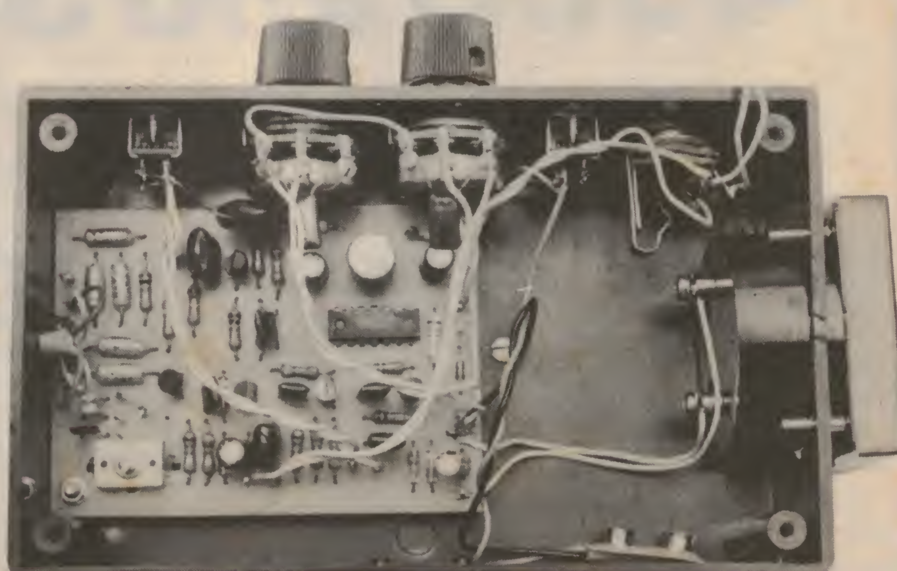
The base plate can then be fitted to enclose the coils, this should be glued in place.

If after glueing in place the balance between the coils is found to be not quite right it should be possible to glue a small piece of metal (such as a washer) somewhere on the head to cancel out the error.

Using The Metal Locator

You will find that finding buried metal is rather *too* easy. 95% will be junk — silver paper being a curse. The search head should be panned slowly over the surface taking care to overlap each sweep the sensitive area is somewhat less than the diameter of the coil.

This type of locator will also pick up some materials which are not metal



— especially coke. And it is not at its best in wet grass.

Think very carefully about where you want to search: this is more important than actually looking. The area you can cover thoroughly is very, very small, but his approach is far more successful than nipping all over the place. As an example of how much better a thorough search is, we thoroughly tried on 25 square feet of common ground (5ft x 5ft); we found over 120 items but a quick search initially had revealed only two!

Treasure hunting is growing in popularity and those who do it seriously have adopted a code; essentially this asks you to respect other people's property, to fill in the holes you dig and to report any interesting finds to museums.

Meter Circuit

Since the circuit is basically sensing a change in audio level, a meter circuit can be incorporated. For the very first indication from the 'crackle' your ears are likely to be more sensitive than the meter but thereafter it will come into its own.

This part of the circuit is optional and the components are not included on the board.

TABLE 1

OBJECT	20_c Coin	Beer Can	150 mm Square copper	150 mm steel rule	MAN'S Gold Ring
HIGH SENS	200 mm	450 mm	550 mm	300 mm	200 mm
LOW SENS	150 mm	350 mm	400 mm	220 mm	150 mm

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Model 1

Speaker Components:
8″ bass driver low frequency
4″ cone driver high frequency

Operational power:
12 watts to 75 watts

Cabinet finish:
Hand rubbed oiled oak

Model 3

Speaker Components:
10″ bass driver low frequency
4″ high frequency

Operational power:
10 watts to 100 watts

Cabinet finish:
Vented enclosure, hand-rubbed oiled oak with acoustically transparent black knit fabric.

Model 5

Speaker Components:
2 each 4″ frame cone drives high frequency
12″ bass driver low frequency

Operational power:
12 watts to 150 watts

Cabinet finish:
Hand-rubbed oiled walnut

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WHK COLOR VIDEO GAMES

Our new 4 color TV CHALLENGER 6000 has a lot improved features common to all games:
BALL SPEED: The ball has 3 user pre-settable speeds; slow, medium and fast. A further control, (speed increment) can be set to increase the speed when four player hits (total by both players) have occurred. The speed will then move on to the next higher speed to that previously set by the user i. e. Low speed hits then 4 medium speed hits then 4 fast speed hits. These speed up features can be inhibited to enable any particular speed to remain constantly set. At the end of each point the ball reverts to the original set speed and the speed incrementer will operate again on the next point.
This feature was designed to give more skill to the game in that, as players become more adept at hitting the ball, the ball speed increases making it more difficult to hit.

SERVING: Serving can be manual or automatic. When in auto mode the ball will serve into play a minimum of 3 seconds after the last point was won. On manual serve the ball will serve immediately that serve conditions are met following the deression of a manual serve push button. The position of serve is random since the ball is always bouncing around even when not visible. The serve is indicated by the bat of the serving player flashing on and off at approx. 1Hz.

ANGLE CONTROL:The players 'bat' is split electrically into 3 disinct portions (top, middle and buttom) and these are used to control the angle at which the is reflected from the bat. In football where multi-hits are allowed a player may follow the ball to deflect its movement.

SCORING: Scoring is indicated by a two digit score displayed in the relevant players colors in the upper half of the screen,- left score red, right score blue. The score is displayed only during the time that the ball is out of play, and leading zeros are always blanked.

THE GAMES

TENNIS: The game is designed to simulate playing methods and rules of table tennis as closely as possible.The display consists of a rectangular court with dotted centreline in white on a background of green. The left player is red and the right player is blue. Each player has vertical and horizontal movement (Joy-Stick-Control) within the confines of his own half of the court the bat being blanked out on entering the opponets half of the court. The game is started by resetting the score which sets initial conditions and gives the first serve to the left hand player. The serve will then alternate every 5 points. To win the game 21 points must be reached with a clear margin of 2 points. If 20-20 is reached then the deuce circuitry operates. This causes the serve to alternate every point instead of every 5 points. The winner will be the first player to gain a 2 point advantage. The game also contains double hit protection in that if a player does hit the ball a second time before his opponent hits it loses a point by default. A double hit is also registered when the ball is served (from the relevant baseline) and the player whose serve it hits the ball before his opponent. This feature is included to prevent a player from staying near the baseline for serves. It means he must move away and get back quickly for the serve return which at fast speeds makes the game more interesting and skilful.

FOOTBALL: This game is designed to simulate English football but could equally be called hockey. This display consists of a rectangular court as in tennis but the left and right baselines are broken to create 'goal areas'. The court outline and centreline are again white. To provide a more realistic simulation of the game 'static defenders' are positioned in front of the goal areas, (approx. one third of goal area is covered by the defender) to act as a goalkeeper. The normal player 'bats' are free to move to any position on the court including the opponents half. The background is green and the static defender colors are red and white to match the normal player colors. To score points the ball must pass through the goal area. The ball will then serve from the losing players side but from the centre line. Since no points target are set in football or hockey the game is won by the number of goals scored in a given time. When reset score is pressed at the start of the game the first kick off is given to the left player and an internal timer is reset, which times out after 3 minutes. Double hit circuitry does not operate in football. This enables a player to 'dribble' and hit the ball as many times as required. This course will operate the speed incrementer and a player can quickly lose control by too many hits.

SQUASH: This game follows the rules and scoring methods of squash but could equally well be called handball. The display again consists of a white courtline with the right hand side totally white to simulate a 'wall'. The background is again green and the players red and blue. The ball in all games is white. Both players can move over the whole court area. The ball is served from the wall and left (red) has first serve on operation of the "reset score" control. To win a point a player must win on his own service be deflecting the ball past his opponent and contacting the left hand baseline. If a player wins a point on his opponents service then he only gains a service and not a point, this simulates the normal scoring precedure of squash.

Double hits feature in squash, as follows:- When the ball comes off the wall either from a serve or in normal play then only one player is elegible to play the ball. i.e. if red last hit the ball or served, then blue is due to play. If red hits again then the blue is automatically awarded a point and the next serve.
Similarly, when a player has played the ball, if he plays again before the ball has contacted the 'wall' he loses a point and the serve. The player reaching 9 points is the winner if a margin of 2 points exists. If 8-8 is reached then deuce operates and the winner is the first player to gain a 2 point advantage.

To save tooling costs our new COLOR TV CHALLENGER SERIES 6000 is housed in the same flat case as our TV CHALLENGER Series 3000.

INTRODUCTORY PRICE $79.50
including post, pack & insurance

This price includes two external handheld controls, mains AC Adaptor to eliminate costly battery replacements & antenna switch

For our old TV CHALLENGER Series 3000 we have now perfected a Rifle (70cm long). This rifle adds 2 rifle shooting games to our 4 game unit (or any other game based on the AY-3-8500 IC). Connection to the TV game is via a 5 core cable and socket. Minimal wiring changes are required in the TV game since all additional circuitry is mounted in the rifle. Scoring is displayed at the end of the game and score reset is provided on the rifle for user convenience. Sensitivity is automatically adjusted in strong ambient light (no pots to adjust). The rifle will not register a false hit even when pointed direct to a strong lamp. This rifle comes completely wired and is ready to use.
PRICE $29.50 plus $4.50 p/p and insurance

TV CHALLENGER Series 3000 is still available at $68.00 plus $3.50 p/p

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Anyone interested to work in our air-conditioned workshop assembling and testing TV games please contact W.H.K. for details.

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LED's red, green & yellow mix. per 10 $1.80
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0-260V, 8A $52.00
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PHOTOGRAPHIC STROBE

This project gives about seven times the light output of the High Power Strobe we published six years ago. It also has other advantages when used by the photographer . . .

THE HIGH POWERED strobe published back in August 1971 has been one of the most popular projects we have designed and it is still being built and sold. A lot of people have since asked if it can be used for photographic use (and if not how could it be modified).

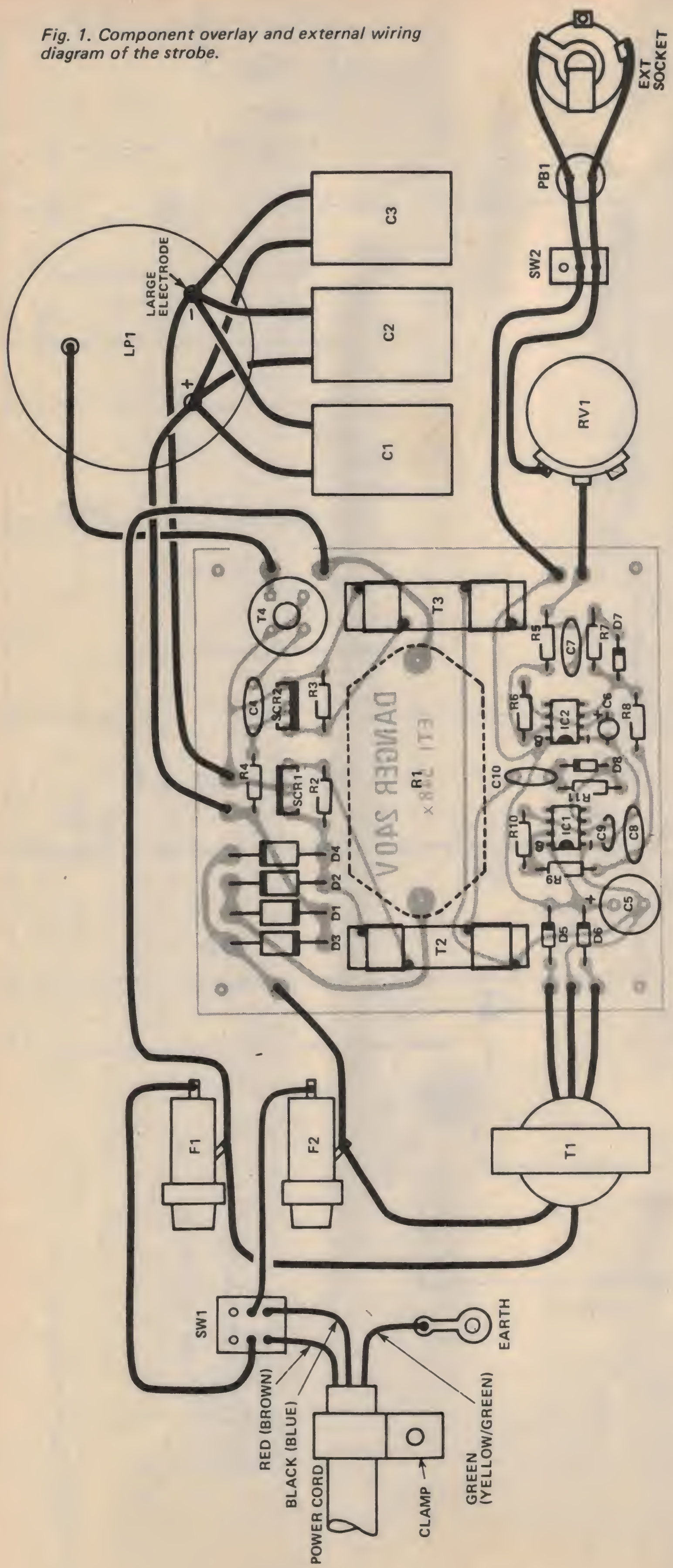
The existing strobe has several problems in photographic use, the main one being insufficient light output. Other problems are that the electronics is all at mains voltage with no isolation, preventing the safe use of a remote push-button control, and that at high speed there is some jitter in the flash rate (since this is partially synchronized to the mains frequency).

This new unit has about 7 times the light output of the previous unit (this can be increased further if needed). The control circuitry is now isolated and the flash rate is steady as there is no synchronization with the mains.

All this however costs more: we have used a larger flash tube, the capacitors cost about $30, and the control circuitry is much more complex. However, if high power is needed the cost is worth while.

The front of the strobe with the perspex cover removed. The cover is necessary to prevent accidental contact with the mains voltages applied to the flash tube.

Fig. 1. Component overlay and external wiring diagram of the strobe.



PARTS LIST — ETI 548

Resistors all ½ W 5%

R1*	36 ohms 1600 W
R2, 3	1 k
R4	100 k
R5-R7	10 k
R8, 9	68 k
R10	33 k
R11	100

* standard jug element

Potentiometers

RV1	rotary 1M lin

Capacitors

C1-C3	30 μ 250 Vac Plessey type 427/1/00813/002 30/250 V
C4	33 n 630 V polyester
C5	1000 μ 16 V electro
C6	1μO 25 V electro
C7,8	100 n polyester
C9	2n2 polyester
C10	100 n polyester

Semiconductors

SCR1,2	C106D, BT100A500R
D1-D4	1N5404
D5-8	1N4004
IC1,2	NE555

Miscellaneous

T1	transformer, 240 V — 12.6 V CT
T2-3	pulse transformer, see Table 1.
T4	trigger transformer, TR-6KM
LP1	flash tube, FC6501
PCB	ETI 548
SW1	240 V switch double pole
SW2	single pole switch
PB1	push button (press to make)
F1,2	fuses and holders. 3A 250 V

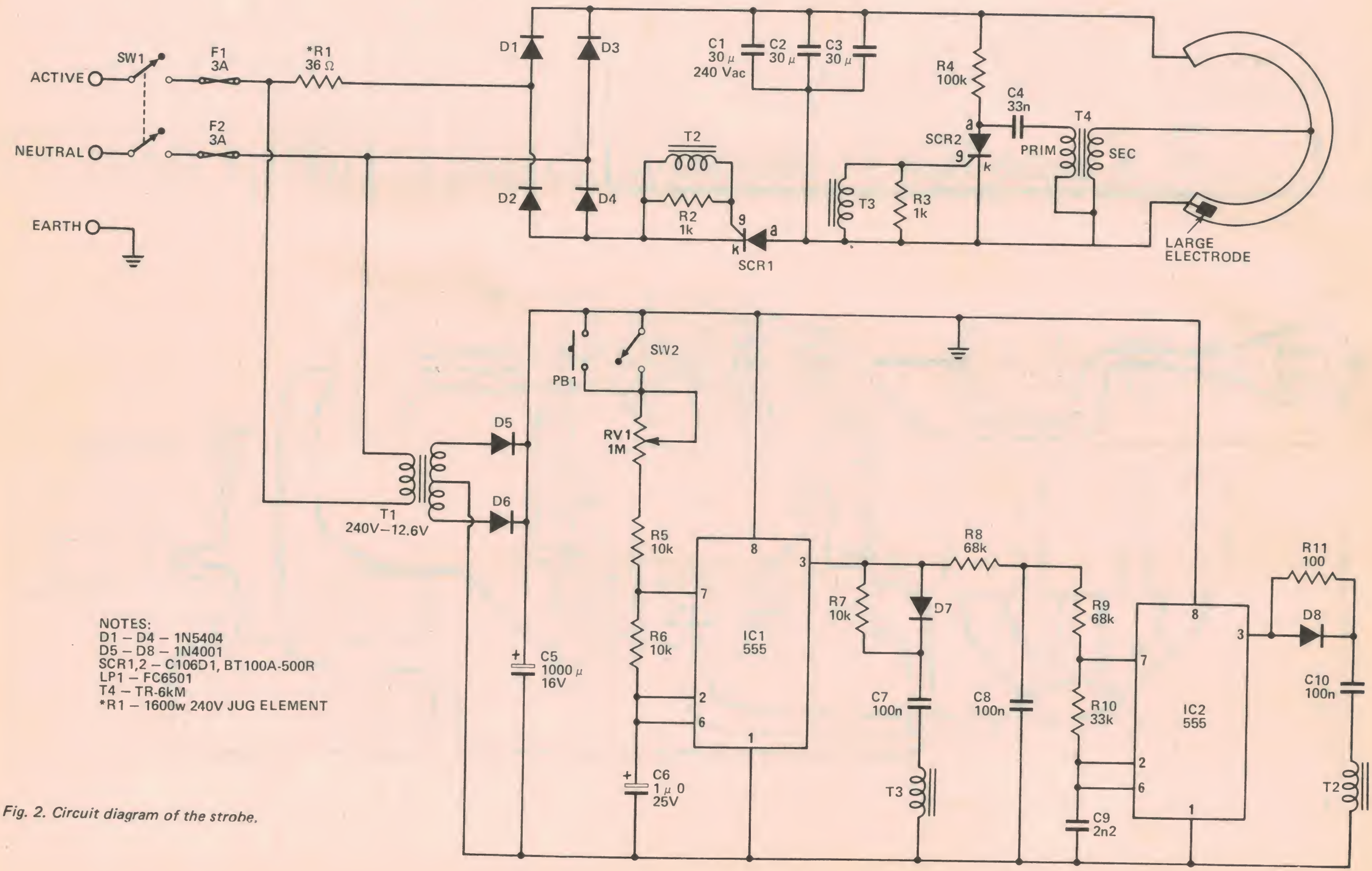
Reflector
Case
Power cord and plug
100 x 100 mm asbestos sheet
five 25 mm metal spacers
four 12 mm spacers.

Construction

The first thing to remember with this project is that a lot of the circuitry is not isolated from the mains. Contact with these components can be lethal. Therefore be careful to ensure adequate clearances to keep these components from contacting the case and ensure all external metal surfaces are earthed.

We mounted the tube on three banana plugs which fit into sockets on a pc board (see Fig. 3). the pcb is in turn mounted on 25 mm spacers attached to the rear of the reflector. The three mounting holes shown for the spacers were positioned to suit our reflector — these may need to be varied to suit another reflector.

The pcb can be assembled with the aid of the overlay in Fig. 1. Ensure all diodes, electrolytic capacitors, ICs, and SCRs are oriented correctly. The pulse transformer can be wound as shown on Table 1 and soldered in place by its leads. Once the unit is checked the pulse transformers should be glued in to prevent the fine wires from breaking. The resistor R1, which is a jug element, is mounted off the board by 25 mm



NOTES:
D1 – D4 – 1N5404
D5 – D8 – 1N4001
SCR1,2 – C106D1, BT100A-500R
LP1 – FC6501
T4 – TR-6kM
*R1 – 1600w 240V JUG ELEMENT

Fig. 2. Circuit diagram of the strobe.

How It Works — ETI 548

To operate a flash tube it is necessary to apply to the ends of the tube a voltage of about 320 volts, with a capacitor also across the terminals. However, this is not sufficient. An additional high voltage pulse (6000 V) is required on a trigger lead. When this occurs the tube appears as a short circuit, discharging the capacitor rapidly. The amount of energy in each flash can be calculated by:

energy = $\frac{1}{2}CV^2$ joules

where C is the value of the capacitor in farads and V is the voltage across the capacitor in volts. For 90 μ and 340 V this gives about 5 joules. A normal flash uses 300 V and 300 μF or 13 joules.

The 240 V mains voltage is rectified by D1-D4 with R1 used to give some current limit. If SCR1 is "on" C1-C3 are charged up to 340 V dc. The SCR is used to allow the power to be switched on and off, which is necessary as the power must be switched off while the tube is triggered on (unless the series resistor is over 500 ohms, but a resistor of this value limits the flash rate). To generate the 6kV pulse the capacitor C4 is charged with 340 V via R4, and if the SCR 2 is triggered on it is discharged into the primary of the trigger transformer, T4, giving the 6kV needed.

Control of the SCRs is done by IC1 and IC2.

The mains voltage is reduced to 9 V dc by T1, D5,6 and C5, giving the isolation required. IC1 gives the timing of the flash rate which is variable from about 2 to 30 per sec. The output of IC1 is normally high (ie, +9 V) goes low for about 10 ms every flash. When the output goes high again the pulse transformer T2 transfers the transition in the form of a pulse into the gate of SCR2 causing the tube to be triggered. Resistor R7 and D7 prevent the negative transition triggering the tube.

When the output from IC1 goes high R8 and C8 provide about a 10 ms delay before IC2 starts oscillating at about 2 kHz. When it is oscillating the pulse transformer T3 keeps SCR1 on. Therefore the sequence of operation is as follows: IC2 oscillates for the duration between the flashes with SCR1 on and C1-3 is charged up. The oscillation stops for about 15 ms which ensures the SCR1 turns off (more than one half cycle) after which time the tube is triggered, discharging the capacitor C1-C3. This takes about 5 ms and after 10 ms the oscillator turns on again recharging the capacitors.

The oscillation can be started or stopped by SW2 or a push button can be used either local or remote as it is not at mains potential.

Fig. 3. This support is necessary when the sockets for the tube cannot be mounted directly on the back of the reflector. Dick Smith has some new reflectors which do away with the need for this support.

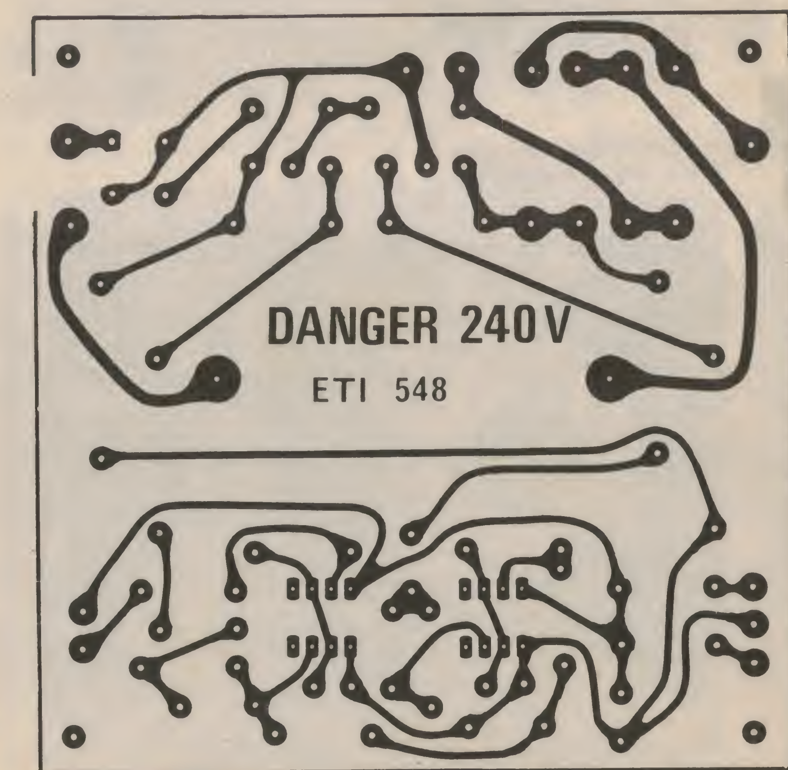
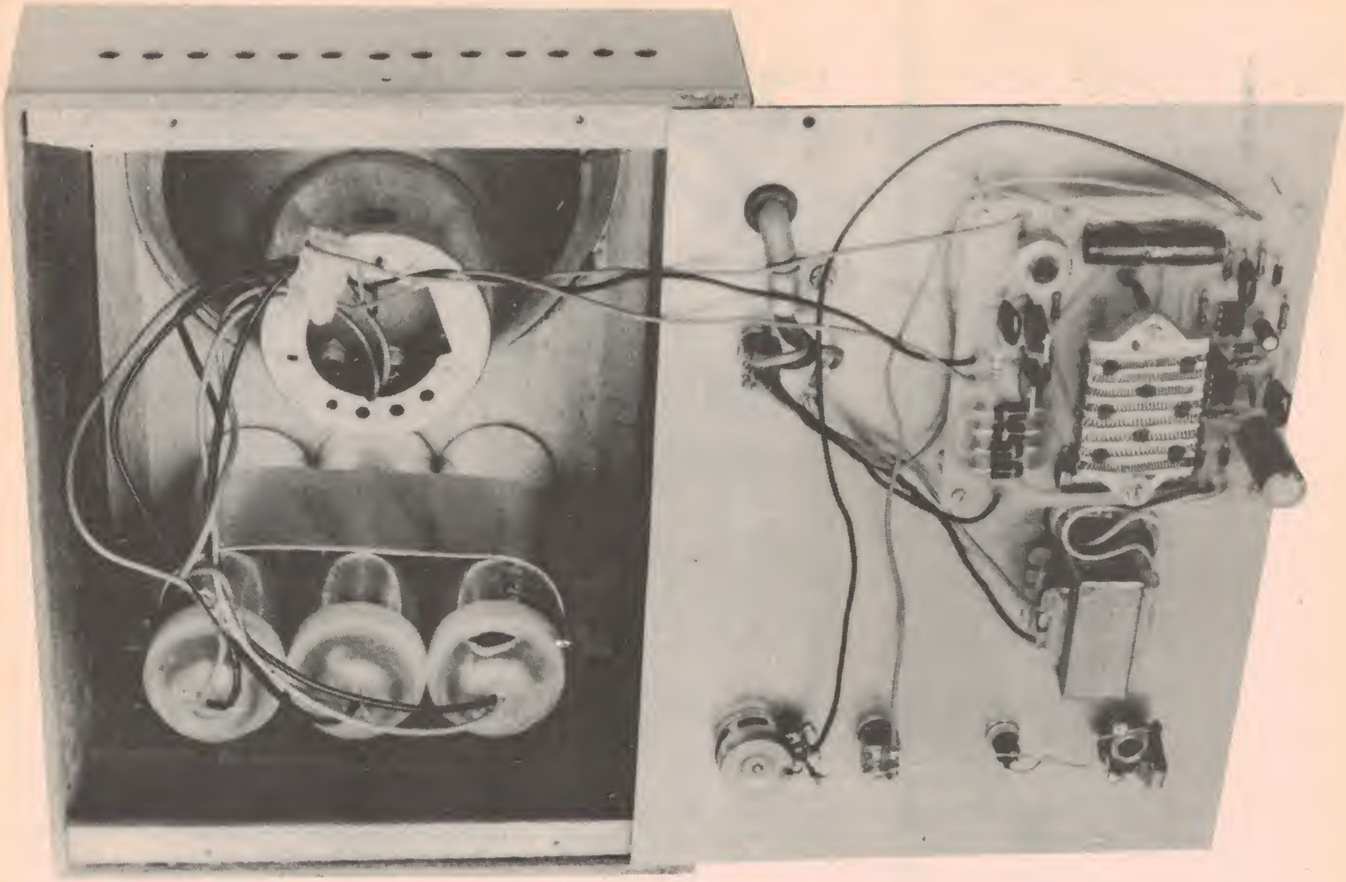


Fig. 4. Printed circuit layout. Full size 100 x 100 mm. Material used MUST be fibre glass due to the heat generated by R1.



long metal spacers to allow for cooling. If you plan to run the strobe at more than 10 or 12 flashes per second a piece of asbestos about 100 mm square must be placed between the resistor and the pcb to prevent heat damage. Similar protection should be given to any burnable substances (the wooden box, if used) near the resistor.

The external (to the pcb) wiring of the unit is also given in Figure 1. The mechanical layout depends on the reflector used and the facility you have for making or purchasing the box. ETI's previous strobe used a metal box behind the reflector to hold the electronics and this approach can easily be adapted. We couldn't find a ready-made box of the right size so we made a wooden box (three ply) with the reflector enclosed. The rear panel (which holds the electronics) is made of aluminium. If this approach is used a row of ventilation holes, about 6.5 mm diameter, should be provided along the top rear and the lower sides. If a metal box is used it will transfer enough heat through the walls without the need for the holes.

Whatever system is used remember again that the circuit is a 240 V (except for the control circuitry) and adequate clearance must be maintained and all

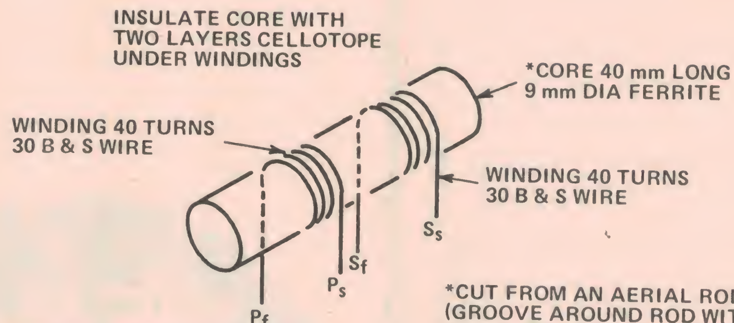


Fig. 5. Diagram showing how the pulse transformers are wound.

*CUT FROM AN AERIAL ROD (GROOVE AROUND ROD WITH A FILE AND SNAP)
NOTE START AND FINISH POSITIONS (THEY HAVE TO FIT THE PC BOARD)

external metal parts, including the reflector, must be earthed. Also a **piece of perspex must be fitted over the reflector to prevent accidental touching of the tube.**

If the unit is intended for a disco the use of the switch SW2, the push button, and the external socket will not be needed and SW2 can be bypassed. Also increasing R5 to 39 k will reduce the maximum rate to about 16/sec.

Stroboscopes are dangerous instruments — they can bring about epileptic fits in people who have a history of epilepsy and also in those who are disposed towards this trouble. There are cases of people who never knew of any epileptic disposition who, under the influence of stroboscopic stimulation, have had fits induced and thereafter have suffered from subsequent, non-induced fits.

Flash-rates in the order of 5 to 12 flashes per second are the dangerous rates in this respect. In the event of such an attack switch the strobe off immediately.

Vol. 1 No. 4 60c*

CB AUSTRALIA

How to get into CB Radio

CB and the LAW

SUBMISSIONS
we look at what's been put forward...

AERIALS

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BASE LOADED ANTENNA
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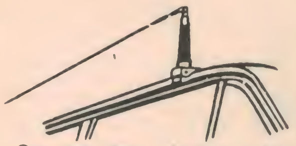

Our new delux folding gutter grip aerial heavy duty loading coil and fold down S/s tip. Snap locks automatically when raised. Loading coil and tip can be removed just leaving gutter grip in position for max security. Complete with cable and plug. **$39.95 P&P $3.00**

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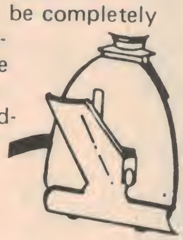

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High Efficiency Ground Plane Antenna for CB base station. All aluminium construction. Accepts PL 259 connector. Solid aluminium 108 inch heat treated radials and radiator. Elements supplied in two 54 inch lengths joined by threaded coupling nuts. Radial droop for 50 ohm match. Accepts 114 inch tubing and PL 250 connector. Frequency Range 27 MHz. Impedance, 50 ohms VSWR Less than 151. Weight 45 lbs. Wave 14.

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CB

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CB AUSTRALIA

Vol.1 No4.

How to get into CB Radio

CB How to get into CB Radio AUSTRALIA

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A MODERN MAGAZINES PUBLICATION
15 Boundary Street, Rushcutters Bay, NSW 2011

COVER:
'Hey Ho skip to my loo.'

SUBMISSIONS– A POOR ATTEMPT

Of all the submissions to the Minister for P&T that I have seen so far, only one really takes a balanced and reasonable look at the issues — not that I necessarily agree with its recommendations. All the others fall down in large part by undercutting themselves. Most show an incredible naivete and lack of understanding with regard to regulations and controls in particular. Some recommendations would be well nigh impossible to implement and enforce, others are blatantly self-seeking — a bit like jobs-for-the-boys, please! The use of 'statistics' (figures anyway) in some submissions are obviously 'presented' in a biased fashion, in support of a particular point, but a little deeper consideration would indicate the fallacies of them.

In short, the standard of presentation of most submissions is very good, professional even, but the rhetoric and arguments presented leave much to be desired.

This situation, I suppose, reflects the lack of maturity of the CB movement as it currently exists. It will have to grow up a lot if the desired CB service, in whatever form, is to survive when CB becomes a reality.

R.H.

IS CB ILLEGAL?

CB is not illegal — provided you have a licence and abide by the rules. If you don't have any other good reason for using CB (for boating, fishing, business, safety, etc) and want to follow radio as a hobby then currently the simplest licence to apply for is the Radio Amateur's (Novice) Licence. Contact the nearest branch of the Wireless Institute of Australia (address as in the phone book) for details.

CONTENTS

IN STOCK NOW!

IBETA 23-Channel AM Mobile Citizensband Transceiver

STILL AT THE PRE-DEVALUATION PRICE OF

$89 + P&P $5.00 (NORMALLY $139.00)

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1. **Semiconductors:** 19 Transistors and 15 Diodes
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JAS677—19

CB NEWS

LATEST NEWS ON SUBMISSIONS

DICK RAISES SUBMISSION

Gore Hill. Dick Smith has released his submission on CB, claiming it to be "a bloody good compromise!". The PR blurb accompanying our copies makes the interesting point "contrary to what might be expected from a person out to make a profit, Dick Smith does not recommend that 40-channel sets be legalised in Australia. Mr. Smith has taken the more rational long-term view that an efficient, well-run service will attract more users than a crowded chaotic system.

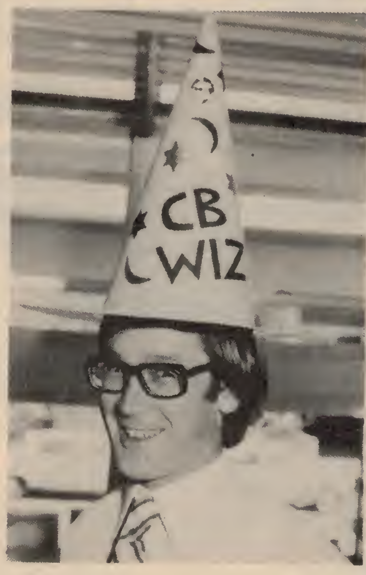
The proposals made in his submission are:—

(a) The system should be allocated on the 27 MHz band with 18 channels corresponding to the US channels 3 through to 20.
(b) Both AM & SSB equipment to be allowed on a similar technical standard to the latest January 1st, 1977 performance specifications of the US service.
(c) As from a date to be fixed all new equipment to be type-tested to comply with the new US specifications and a charge to cover the cost of testing made by the testing authority.
(d) Licences to be made available at the point of sale and all unlicenced current illegal operators to be given an amnesty for a period of sixty days.
(e) No test or mandatory club membership to be required for licencing.
(f) Amateur Radio Operators to be issued with a CB licence at no charge. The Amateurs must operate according to the 27 MHz regulations with type-approved equipment.
(g) Base & Mobile operation to be allowed and no restrictions to be placed upon type of message except as outlined in text.

Dick's submission suggests that CB in Australia should be operated much the same as it is in New Zealand.

He claims that a UHF service would be prohibitively expensive and that there would be little use in introducing a UHF CB allocation.

His point-of-sale licencing proposal recommends the retailer accept responsibility for buying licences in bulk and reselling them to purchasers of CB equipment. The submission also recommends an 'amnesty period' of 60



days for current illegal operators to get a licence.

Dick Smith's report comes in two parts, one which looks at general aspects of CB and one listing suggested conditions of operation (rules, procedures, etc). Copies obtainable from Dick Smith.

NCRA SUBMISSION ON SALE

Sydney Central Railway (April 18th). At a press conference at the AJA Club today the NCRA released their 109-page submission on CB. They make thirty two recommendations, the main ones being as follows:—

(a) That a 'Citizen Radio Communication Service' be established in the 27 MHz band (26.960 – 27.300 MHz) using the old 23 channel USA system, with a supplementary band on VHF or UHF.
(b) Proposed users obtain a licence after passing a basic operational procedure examination , which would cover non-technical information and should be likened to a motor vehicle driving test.
(c) Licence fee to be $10 a year for individuals and $15 a year for families.
(d) The NCRA be recognised as the national body responsible for administering the service as the self-regulating, self-licensing, self-disciplining authority backed by Government legislation, thus being the body responsible for all Citizen Radio Communication Service activity.
(e) All fees collected be set aside in special accounts, and that 80% of all licence fees should be used in both the administration and improvement of the service and that no more than 20% of all licence fees should be added to consolidated revenue.
(f) They recommend that CREST be authorised by the Government to develop, in full, (?) a reliable working Road Safety Service on a national basis.
(g) To allow for changes that the proposed Citizen Radio Communication Service will make in the 27 MHz band, they propose that the 11 metre and 80 metre (?) Amateur allocations be changed from 26.96 – 27.23 MHz to 26.69 – 26.96 MHz and 3.5 – 3.7 MHz increased to 3.5 – 3.9 MHz.

Which is all very interesting. As you can see, good old option two from the P&T report comes in for another try from the CB camp. In common with the other submissions discussed elsewhere in this issue a minimal examination is proposed along with technical controls on equipment, etc.

The NCRA also recommended that automatic transmitter identification be used — a rather unique proposal! I guess the user pays for the technology. So much for cheap CB equipment. The cost is not discussed in the submission.

The NCRA submission recommends a period of three months to allow current illegal users to become licensed.

Copies of the submission are obtainable from the NCRA for a recommended price of $3.

NOVICE LICENCE — No Tenure & New Band!

In March the RFMD of the P&T advised that there is no two-year tenure on the Novice Licence as was originally believed to be the case. Sighs of relief and cough up your $12 every year.

The RFMD also advised that Novice Licensees will be authorised to use 28.1 to 28.3 MHz on the 10 metre amateur band as soon as arrangements can be made.

ERRATA

In CB Australia Vol. 1 No.1 page 25 we listed the IBETA23 and gave a cost of $140. This is incorrect — the correct price is $89 as advertised by CHS Taylor's Warehouse Sales.

POST FREE

Great Mail Order Offer

MAIL ORDER BUYERS NO LONGER PENALISED. We pay post and packing charges. We reckon you shouldn't be penalised for not living in Sydney (where we've got the BEST BUYS in electronic components etc.) **All items in this ad will be despatched within 24 hours (except out-of-stock lines, of course).** And no minimum order value, either! But sorry, COD not available.

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63	500 1/2W resistors	$4 00
24	100 1W resistors	$1 50
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73tl Logic Trainer	$2.40
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3.3	50	P.T.	.20
4.7	25	PCB	.20
4.7	50	P.T.	.20
4.7	500	P.T.	.40
8	500	P.T.	.70
10	25V	P.T.	.20
10	63V	P.T	.25
10	315V	P.T.	.50
16	500V	P.T.	.70
22	16V	P.T.	.20
22	25V	PCB	.20
22	63V	P.T.	.25
33	10V	PCB	.20
33	25V	PCB	.20
33	35V	PCB	.25
33	50V	PCB	.25
47	12V	PCB	.20
47	25V	PCB	.25
47	35V	PCB	.25
47	35V	P.T.	.25
47	350V	P.T.	$1.30
100	10	P.T.	.20
100	25	PCB	.30
100	63	P.T	.35
100	63	P.T.	35
100	63	P.T.	.35
100	350	P.T.	$1.40
220	25	PCB	45
220	35	P.T.	.45
220	50	PCB	65
220	63	P.T.	.65
330	10	PCB	.35
330	16	P.T.	35
330	50	PCB	.70
400	40	P.T.	.50
470	10	PCB	50
470	16	P.T.	.50
470	25	PCB	.55
470	50	P.T.	.55
470	50	PCB	.70
640	16	P.T.	60
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1000	25	PCB	85
1000	35	P.T.	$1.00
1000	63	P.T.	$1.30
2200	16	P.T.	.95
2200	25	P.T.	$1.40
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7409	.50	7491	$1.40
7410	.50	7493	$1.10
7411	.50	74100	$1.00
7412	.80	74107	$1.00
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7416	$1.00	74145	$1.00
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7427	$1.00	74154	$3.45
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Resistors — Preferred values viz: 1, 1.2, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2, and multiples, 1 ohm to 10 mg in 1/4W, 1/2W, 1W — 3c ea or $2.50 per 100. Most values 5W — 20W price 5W — 45c 10W — 75c

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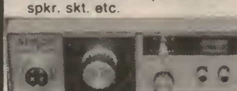

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6.5mm jack	45c	35c
6.5 stereo	65c	45c
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2.5mm DC	40c	25c
2P AC power	55c	35c
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COME-ON

We Hand The Mic To Our Readers...

AM/FM/CB.

Sir,

After reading your articles in C.B. Australia Vol. 1, No. 1 and No. 2 I have become interested in getting a CB Radio and antenna for my Suzuki. Is there any way of using an AM/FM Radio/CB Radio Coupler with any antenna when I get the CB. I would like to have a Quarter Wave Whip, and briefly why or why not I could do it. I would appreciate it greatly if you could help me.

T.S.
Coff's Harbour

This problem must face many people trying to get into CB. We cannot find a commercially built coupler for use with a quarter-wave whip and an AM/FM radio. In a future issue we shall describe how to build a simple filter to do this.

CB SUPPLIERS

I hope you can help me with a small problem. I require the distributor's names of the following CB sets: ROYCE; Hy-Gain ; SBE and COBRA. I hope you can answer my question.

G.H.C.
S.A.

Thank you for your enquiry concerning CB sets. We apologise for omitting to put Mobile One as the supplier of *Hy-Gain* in the latest issue of CB AUSTRALIA. *Hy-Gain* are made by the same people as Hi-Range.
Mobile One stock both *Hy-Gain* and Cobra — Royce and SBE are not yet available in Australia. However, we believe that they may be stocked by Mobile One in the future.

SHIELDED IGNITION

I was most interested in your article in C.B. Australia Vol 1 No 1 concerning installing a transceiver in a motor car. In the article it was indicated that one could purchase a completely shielded ignition system however I have not been able to locate a distributor who sells these. I would be most obliged if you could let me know where such a system might be obtained and some idea of its cost.

R.J.F.
NEWTOWN, TAS.

The only distributor of complete shielded ignition kits we know of are Vicom in Melbourne: 139 Auburn Rd., AUBURN 3123. VIC. Ph. (03) 82-5398.

ACT NEWS.

Dear Sirs,

Ye Gods! What qualifications you gentlemen have.

It startled me somewhat to see that you have printed my letter, no doubt your readers would be dying to hear the latest on CB in Canberra. Canberra, and 6 regional clubs, all affiliated with the Charlie Tango Club, which is in turn affiliated with the NCRA. The Charlie Tango Club still remains the largest club, with callsigns now in the 900's.

Now every Tuesday night there is the "Charlie Tango Double Zero" news broadcast (sometimes with airborne DX callbacks), every Monday night there is the "Committee on the Air", Thursdays and Saturdays "Ladies Hour", (where no men dare call "breaker"), and Monday afternoons "Kiddies Hour", for the junior Charlie Tango members (and big "kids").

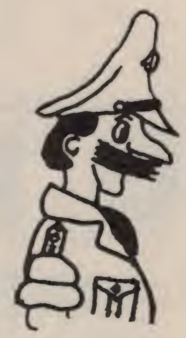
CREST in Canberra now covers from Goulburn through to the A.C.T.s' southern border. Also some service stations in Canberra and surrounding districts area have made approaches to CREST, offering to set up and staff CREST monitoring centres on their premises (a copy of one of these letters being reprinted in the NCRA submission to the Minister for P&T, Mr Robinson.)

A monthly news magazine has also appeared in Canberra "CB NEWS", which is full of the good news for CBers. Also the Charlie Tango Club now has it's own magazine "Charlie Tango Territory".

As for VKs, my new boss is a VK and is friendly to both CBers and the idea of a legal CB service. Also he is always ready with hints on how to improve or modify various CB equipment.

Keep up the good work, and I look forward to your future editions with bated breath (for fear that if I breathe out the escaping air will emit a high pitched CB sound, and thus lead the RIs to my 10-20!) . . . .

COLIN (The "Colonel")
CHARLIE TANGO 142
A.C.T.
MY SIGN "THE COLONEL"



NEW CLUB.

Sir,

We the members of the PL-259er Club, wish to introduce ourselves to CB Breakers of Sydney andother parts of the country who may be in the position to follow our example in integrating all breakers with each other.

Our story begins:

At the Canberra Convoy, on Sunday 13th of this month (March), three other CBers and myself got together at an eyeball and decided that something had to be done to bring breakers closer together in a common cause to prove in our own term that CB radios and their operators should be recognised by the powers that be, and legalised.

As we were all from the Eastern suburbs, we then decided that we would form an eyeball club where we could meet any time (24 hrs a day) and socialise over a cup of coffee, tea, chocolate or what have you and get to

COME-ON

We Hand The Mic To Our Readers...

continued from page 11

know one another and discuss matters of the day and other things relating to our hobby, CB.

We decided to charge a nominal fee of $1 per week and this was to be used for the purpose of buying refreshment supplies, Post Office Box, Stationary, Postage stamps etc. and all monies that were left were to be placed in a special club bank account and pooled until the end of the year to pay for one giant eyeball as a Christmas party. We had to make one stipulation however, members will have to have been financial members for at least 20 weeks to be entitled to be elligible for participation at the yearly party.

At the moment, my home 20 is the H.Q. and club house, but in time we hope to expand enough to lease a house for the purpose of club rooms.

We welcome enquiries from any persons that may be interested and all requests for further information should be send to

The PL-259'er Club
Post Office Box 129
BONDI BEACH
2026
N.S.W.

Sirs,

I have a problem with my antenna and I hope you can help me. I'm using a AM/FM antenna with a CB coupler. I find the SWR keeps changing whenever I check it, say once a week or sometimes more. The SWR has changed either gone up or down. Why is this?

J.T.
Bathurst

The SWR can be affected by many things — for instance, moisture entering the coax (feedline) at the antenna and can affect the termination impedance. Trees or large bodies of metal etc. Will also have odd effects.

You will also find that dirt, grease and other substances will lodge between the segments of the antenna (particularly AM/FM antenna) changing its impedance therefore affecting the SWR.

To check the SWR find an open area with nearby obstacles at least 40-50 feet away so as your antenna is not effected.

QUALITY CB? SEE DICK

Dick knows you can buy CB at 'bargain' prices. But have you ever heard of the brand names before? And what happens when something goes wrong — where's the service back-up? Before you buy CB, ask around; see what most CBers are using. Quality brands, respected names — with service and spares back-up. Then see Dick Smith for a quality unit. 10-4!

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MIDLAND 882C $179.50

THE MOST POPULAR AM RIG IS THE 882C
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Cat. D-1436 .. .. $179.50

23 Ch SANYO

SAVE BIG MONEY!

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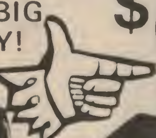
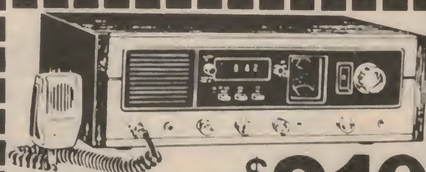


SAVE! SAVE! SAVE! SAVE! SAVE! SAVE!
Two years ago, we sold the value-packed Sanyo TA-901C 23 channel rig for $139.50. Two years of inflation & devaluation should have pushed the price way over $200.00 Dick's 1977 price is less than half that figure! Unbeatable value for a respected brand with all features and a full service back-up. You really can't go wrong here!
Cat. D-1160 .. .. $99.50



12V DC/240V AC MIDLAND $219

THE POSE MACHINE . . .
As well as being a high performance CB to impress you, this beautiful wood-grain case base/semi-mobile rig will be the envy of all your friends. You get the convenience of a dual supply base, PLUS a digital clock, PLUS a built-in SWR meter — about $250 worth if bought separately. And it's only $30 more than the 882C. Really fantastic value.
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ALL TRANSMITTING EQUIPMENT REQUIRES A P&T DEPT LICENSE.

THE NEW IMAGE
Just released — this top loaded 'truckies friend' antenna. Comes with universal thread for most bases. Smart appearance, hi performer.
Cat. D-4452 .. .. $29.50

29.50

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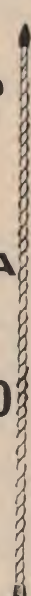

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Looking at SUBMISSIONS ON CB

Roger Harrison VK2ZTB

As CB begins to look like a practical proposition for Australia, everyone has different ideas on how to run it.

SINCE THE RELEASE of the P&T report on CB some months ago, a number of groups and individuals have made submissions to the Minister, Mr Robinson, on the introduction of some form of "Citizens' Radio Service" to Australia.

Looking at the submissions I have seen so far, there appears to be quite a few areas of agreement but also quite wide disparity on a range of questions.

The P&T report listed three 'options' for an Australian CB service as a starting point for discussions and these have obviously given a lead to some of the suggestions presented in submissions. The summary in the report largely explained the P&T Department's attitude, and submissions have in places, both agreed and disagreed with points raised, both in the summary and elsewhere in the report.

So, before reviewing submissions, let's have a look at the summary in the P&T report and the three options they presented for a CB service.

P & T REPORT SUMMARY OF PAPER

118. There is strong pressure in the community for the introduction of a Citizen Band radio service which is a two way radio communications system used by citizens for passing personal messages over short distances. Radiocommunication services have been established in Australia based on demonstrated needs. This criteria is not met in the case of a CB service.

119. The people seeking the introduction of a CB service would like to see the USA CB service adopted. It is felt that the regulatory provisions of the USA CB service are not well known or understood. These are shown at Appendix A. The FCC has experienced difficulties in the administration of the USA CB service (Appendix B) and has recently introduced new technical specifications for acceptable CB radio equipment and allocated another 17 channels (making 40) to try and overcome the problems of interference and user congestion. Some of the FCC's problems have arisen because of the great interest in CB radio in the USA which has led to a boom in the number of users.

120. One result of the new USA technical specifications has been to make some CB equipment obsolete and these obsolete transmitters are being imported and sold to people in Australia. It is illegal to operate these radios without a licence and to the end of 1976 it was believed there were about 20,000 illegal operators although this figure could now be higher.

121. Action needs to be taken to control or ban the importation of obsolete USA 27 MHz CB radios.

122. The Australian administration is a member of the International Telecommunications Union is bound to comply with ITU philosophies on the establishment and management of radio services and ensure that new services are introduced using the most modern types of radiocommunication apparatus.

123. There are a number of different types of radio services in Australia and it is believed that the demands for a CB service could be met by, if necessary, modifying some of the restrictions.

124. If a CB service is considered necessary then it should be based on sound regulatory procedures and technical specifications. In this regard, the USA regulations and specifications might be taken as a guide.

125. For various reasons the Australian administration would find it a difficult task to remove the illegal operators but there are a number of problems associated with legalising their activities. These problems largely revolve around the technical features of 27 MHz (HF) radio equipment and include the potential interference to other authorised services and home entertainment equipment.

126. It may be possible to overcome these problems through technical specifications and regulatory controls.

127. The introduction of a CB service could provide a significant stimulus to the Australian electronics industry, bring safety benefits to the community and expand the present hobby interest in radio.

128. Some difficulties may arise in protecting the use of the telephone system and other authorised radio services as well as detecting criminals or people making false, obscene and malicious calls. For discussion purposes, a number of options follow which suggest ways in which the demand for a CB service could be met.

The definition of a 'Citizens' Band radio service' in para. 118 seems a bit limited, as noted in some submissions (see later). It appears that there are, in reality, three distinct motivations for using CB, viz: (1) as a hobby, purely for recreational purposes, talking to like-minded people via radio communication but with minimal technical interest, a social activity largely; (2) as a community service, for such purposes as demonstrated by CREST etc.; and (3) for the conduct of business and personal affairs — as it seems to be used amongst truckies and in rural areas.

The hobbyists are largely interested in making contacts locally and DX, eyeballing, club activities, etc, spring from this. CREST and other community service activities are sort of a voluntary 'public service' thing, linked partially with the hobbyists. The WIA divisions have each had a "Wireless Institute Civil Emergency Network" (WICEN) subsidiary for many years — which has been used by the public authorities on quite a few occasions.

The P&T report emphasises adequate equipment specifications and regulation of operation throughout. The report points out that the introduction of a CB service could provide a 'significant stimulus to the Australian electronics industry . . . ' which is a point to remember, but it begs the questions of how much and what sections — import, retailing or manufacture?

Protection of existing services is raised in para. 128 but it appears that the amateur service is the most interested in protection, closely followed by existing communications users of the 27 MHz ISM band.

ITU regulations come in for a mention and this is the area which could provide some very thorny problems if a CB service is introduced on 27 MHz. Particular problems involve 'non-specific' use of HF frequencies (below 30 MHz), interference beyond national borders along with 'third-party' traffic.

In para. 123 of the report (the summary), it is mentioned that the demands for a CB service could be met by modifying some of the present restrictions. This aspect is not dealt with in detail in the submissions and, I think, could have been given a lot more attention. Then again, I haven't seen all the submissions presented to the Minister. For those interested in CB, or CB-style licensing and operation, for business, etc, purposes, the current licensing and regulation structure could be modified to accommodate this sort of activity. Hobbyists and those interested in voluntary community service could be accommodated under a separate system as their motivation and requirements differ substantially from those interested in conducting their business and personal affairs with the assistance of radio communications. This approach is adopted in some of the submissions.

OPTION ONE

Meet the demand for a CB service by modifying existing services.

129. A number of services already exist which by modification could be adapted to meet the genuine community demand for radiocommunications. The restrictions could be lifted on the handphone service allowing people to become licensed to operate low power two way radio equipment. A road safety service could be established based on the present service which exists for small boats, life saving clubs etc. The hobby use of radio can be met through the Amateur Radio Service.

Benefits

- *Regulated services exist and meet the present administration policies.*
- *Genuine needs can be met through the existing services.*
- *Currently existing inexpensive equipment can continue to be used.*

Disadvantages

- *It would be necessary to detect and remove illegal operators from the airwaves which will be a massive task given the present staff restrictions.*
- *Existing services do not appear to meet the demand for a CB service.*

OPTION TWO

Introduce a CB service using the radio frequency spectrum space allocated to the USA CB service.

130. A CB service could be introduced in this form provided that, the equipment used conformed to present USA technical specifications, SSB mode of transmission was used, the service was genuinely restricted to mobile operation and channels other than those used in the USA were allocated.

Benefits

- *It may be possible to accept much of the SSB equipment now being used.*
- *It would be possible to allocate up to 20 SSB channels.*
- *It would provide a stimulus to the Australian manufacturing and retailing electronics industry.*

Disadvantages

- *There would be an increase in the cost of equipment now being sold and used.*
- *There may be criticism from the ITU.*
- *It is not possible to restrict transmissions to a short distance.*
- *Other users of this part of the spectrum (Amateur Radio Service) will probably oppose this suggestion.*
- *For technical reasons, 27 MHz equipment does not provide the best quality transmissions.*
- *It will be necessary to detect and remove a number of illegal operators.*
- *A ban will have to be placed on the importation and sale of non-approved equipment.*

OPTION THREE

Introduce a CB service using UHF equipment.

131. From an international viewpoint the Australian administration has more discretion in its use of the UHF part of the radio frequency spectrum. UHF transmissions are more reliable and for all practical purposes do not cause or are subject to interference. This must be considered of significance when it is claimed that a CB service provides safety benefits to the community.

Benefits

- *Adequate spectrum space is available.*
- *There would be no criticism by the ITU.*
- *There would be a significant stimulus to the manufacturing and retailing electronics industry.*
- *Technical specifications can ensure the service meets its designed end.*
- *UHF equipment is not subject to nor cause interference.*
- *It would be possible to operate both fixed and mobile stations using the same equipment.*
- *UHF equipment would be comparable in price to HF equipment used in Option 2.*

Disadvantages

- *Present illegal operators would not be able to convert HF equipment to UHF thus rendering all present equipment obsolete.*
- *It would be necessary to detect and remove illegal operators from the airwaves.*

There are, naturally, many more options that could be devised but the three mentioned really constitute some sort of starting point from ideas that were already extant when the report was written.

Looking at SUBMISSIONS ON CB

Well, what options do the P&T suggest? These are presented in full below, but here is a brief summary:

Option One involves modifying or extending the existing regulations and services. This is a minimum effort, lowest cost, sort of low-profile option — what might be called a BOAC solution (ie: 'with a minimum of fuss').

Option Two The introduction of a US-style CB service. Very popular with many CBers. Appears fraught with difficulties for Australia.

Option Three Introduce a UHF CB service. Popular amongst amateurs, especially with various WIA divisions. Has some good points but is also fraught with difficulties. Many dollars are already invested in 27 MHz gear.

SUBMISSIONS

The submissions reviewed here are those drawn by The Citizens Band Radio Study Group (from Canberra), The Executive Committee of the WIA ACT Division (Canberra again), the Citizen's Amateur Radio Movement (Sydney) and the Federal Executive of the WIA.

In addition, the NCRA submitted proposals in the form of a petition to the Minister and I have included this as well. (The NCRA released details of a 109-page (!!) submission just as this article went to press — see news).

The Citizens Band Radio Study Group

makes twelve recommendations that are largely concerned with regulations for a US-style 23 channel service on 27 (Submission reproduced elsewhere).

To me, the 'rationale' in support of their recommendations is somewhat brief and perhaps a little separated from the reality. Only the American scene is cited and then in a somewhat idealistic fashion. They make the rather unique suggestion of having a trial period for a CB service. The main recommendations are similar to many proposals published in the media, that is for a 23 channel service, although no band is specified (?). I guess it is assumed that 27 MHz is the desired band. Another unique suggestion is that state and territory police vehicles be fitted with CB to allow communications between mobile CBers and these authorities in the interests of safety. Traditionally, in

Rationale For CB Radio

Communication is and has been always a necessary condition for human beings to act socially.

Radio offers a communication advantage not to be found with newspapers or magazines. This is that it more readily allows a depth of personal feeling to be conveyed.

CB Radio used in this way creates for the listener a feeling of psychological closeness to the communicator.

In Australia the primary responsibility for the regulation of radio broadcasting is vested in the Department of Post and Telecommunications which enforces the provisions of the broadcasting and Television Act.

Today, throughout Australia more than 30,000 CB Radios are in use with an estimated 50,000 operators engaging in this illegal activity.

Many CB Radio operators cannot understand why citizens in North America can enjoy this means of communication while they are being denied this opportunity.

In the United States of America the Federal Communications Commission provided in 1958 with the introduction of a Class D Citizen Band licence an opportunity for the public to participate in the use of transceivers.

In 1974, following nationwide publicity the American public were made aware of CB Radio as a means of saving life and assisting law enforcement agencies in the course of their duties.

The Illinois Police, the Missouri Highway Patrol and the Ohio State Patrol were among the first to use CB Radio to communicate directly with motorists to control traffic and warn of road hazards.

The growth of Citizen Band Radio on the American continent has now reached very large proportions, an estimated 2 million use the medium for work, leisure and community life.

A major reason for the use of CB Radio must be that it provides the communicator and listener with a feeling of psychological closeness.

It Is Recommended

1. *That a trial period of ONE YEAR be introduced to provide Citizen Band Radio operators with an opportunity of proving their responsible attitude to this new medium.*
2. *That only 23 Channel AM and SSB be legalised.*
3. *That no one under the age of 16 years be permitted to obtain a licence.*
4. *That State and Territory police vehicles be fitted with Citizen Band Radio so as to enable them to communicate directly with motorists in the cause of safety.*
5. *That dealers be permitted to issue temporary licences while the application for an operator's licence is being processed.*
6. *That Citizen Band Radio users be provided with guidelines on how to conduct themselves while making use of the airwaves.*
7. *That channel 11 be accepted nationwide as the call channel.*
8. *That channel 9 be accepted nationwide as the emergency channel.*
9. *That all conversation be limited to FIVE MINUTES with a ONE MINUTE break before the next conversation takes place.*
10. *That CB users be advised that the following will be punishable offences:*
    - *(a) Obscene or slanderous statements made over the airwaves*
    - *(b) The use of advertising material over CB Radio*
    - *(c) The contravention of Copyright Laws through the playing of phonographic recordings over CB Radio.*
11. *That all users of CB Radio should become the member of a recognised CB Club.*
12. *That a Working Party be set up to report on the progress of the ONE YEAR trial period.*

The idea is not without precedent and rates a mention in para. 51 of the P&T report. You have to belong to a recognised boating association, SLSC, etc, to get a 27.88 MHz operator's licence at present.

Australia, inter-service communication is not allowed so that this proposal may meet with some difficulties, if not opposition. At first glance, such a provision would be open to abuse rather easily but, when you look at the rest of their recommendations, few people would dare abuse it. Recommendations 9 and 11 seem a little 'heavy' if not draconian. What was all that vitriol in the media previously about heavy-handed beauracracy and over-regulation, etc? Number 11 smacks of 'compulsory' unionism — which would certainly be a big no-no with many. I rather fear that the Citizens Band Radio Study Group have overdone the 'responsible attitude' bit.

The Citizens Amateur Radio Movement

The Citizens Amateur Radio Movement supplied the most detailed and documented submission I have seen. Actually, the group made their submission in two parts, a preliminary followed by a final submission. Both are quite detailed and impossible to reproduce in full. The final submission covers the same ground as their preliminary one and expands on it, so it is that I will review here. If you are interested in the whole submission you could write to:

CARM
c/- Sam Voron
2 Griffith Ave.,
EAST ROSEVILLE
NSW 2069

The CARM submission commences with quite a good definition of CB in Australia as it exists, and as it is seen by CBers. I quote:—

" . . . CB is seen by those who use it as being a recreational hobby communications and community service activity."

which sort of sums it up. And the submission goes on to make a number of related points regarding CBer's motivation:

"Most of the activities in which the CB movement is engaged illegally they could do quite legally with a novice Amateur licence. What is being questioned by the CB movement is the necessity of the hobby novice licence requirements of morse code and electronics theory in regards to the ordinary citizen with a very limited technical background who wants to participate in the same fundamental hobby which the technically skilled Amateur is engaged in, ie: to engage in the hobby of recreational radio communications and by employing this interest into worthwhile pursuits such as community service activities."

All of which seems to be largely true of the current scene on 27 MHz. CARM did not forget the business and non-hobby users either, as they go on to say:

"The concept of short range communications to facilitate business and personal non-hobby users as defined by American CB does not correspond to the majority of users in Australia, although in rural areas this concept has been reported to be in operation and would no doubt increase with legislation."

So they forgot the truckies but you get the drift.

The CARM submission makes two basic recommendations. They propose legislation as follows:—

"1. A communicator amateur D class licence to cater for those interested in recreational hobby communications and community service activities on the 27 MHz band."

"2. A short range business and personal non-hobby service on the UHF band. (Until equipment is available at reasonable cost and performance a shared allocation could be assigned on the 27 MHz band for current users in such a non-hobby service.)"

In essence, CARM propose a compromise of options one and three put forward in the P&T report. Number one above proposes an extension of the existing Amateur service. The ITU regulations would possibly have to be 're-interpreted' to achieve it but Japan and Denmark seemed to have accomplished this. Thus, 'skip' could be worked legitimately — which is not allowed in the USA and is causing the FCC some headaches. The idea has some fairly obvious advantages, current equipment could be used and the pirate problem would largely be submerged in the rush. Other schemes would leave a large pirate 'residue' and a big problem for the P&T.

The introduction of a 'communicator' grade of Amateur licence would almost certainly meet with opposition from some amateur quarters. Many 'full-call' amateurs disdain limited and novice licensees. Such persons ignore the fact that such attitudes are against the basic 'spirit' of amateur radio. The old WASP (White Anglo-Saxon Protestant) ethic raises its warty head again ("I sweated for two years to get my licence, etc, etc."). They still debate whether limited licensees should be eligible for full membership of the WIA (and thus be allowed to vote). Such discriminatory thoughts are still extant (and are boringly over 20 years old). VK2 WIA members better watch out or Nifty Nev will be after you if such ideas get off the ground.

The second proposal by CARM is essentially the P&T report's option three. It seems sensible to separate hobby uses from non-hobby as the basic aims and requirements are fundamentally different.

The CARM submission argues that the non-technical hobby users become part of the Amateur service as they are linked by the fact that both are pursuing a recreational interest in communications but at different levels — a situation which exists amongst licensed amateurs anyway. They point out that:

"The alternative is to say that CB is a recreational hobby communications and community service activity for the citizen with a very limited technical background while saying that Amateur Radio is for those with a large amount of technical background who are engaged in the same recreational hobby activity." "This would have the effect of separating the two groups on a class basis — for the technically skilled (Amateur Radio) and the same hobby for the non-technical radio communication hobbyist (CB). This type of situation only breeds antagonism and hostility. It will result in a hobby which separates its enthusiasts in two distinct groups (one called Amateur Radio and the other called Citizen Radio).

That may very well happen anyway if a Class D amateur licence is introduced as evidenced by my previous comments. Regardless of that it's one of the best ideas I've heard to date. It seems acceptable at present amongst both amateurs and current CBers.

The CARM proposals regarding a Class D or communicator Amateur licence are reproduced below.

Note that proposals 8 and 9 are no longer applicable (see news this issue). According to recent information from the Radio Frequency Management Division of the P&T the Novice licence does not have a two-year tenure as was previously thought. In addition, the RFMD are to allow Novice operation in the 10 metre amateur band, between 28.1 MHz and 28.3 MHz in the near future.

Looking at SUBMISSIONS ON CB

Features which a 4th. Class or D Class of amateur communicator licence would include and its effect on the grades of amateur licences.

1. *Use of type approved 23 Channel equipment.*
2. *No internal transmitter adjustments allowable except by novice, limited and full licencee holders.*
3. *Power limited to 5 watts dc input on AM and 15 watts pep input on SSB coinciding with equipment currently available.*
4. *Communications limited to within Australia.*
5. *The setting aside of channels for specific purposes, eg, Channel 9 as an emergency calling channel, Channel 14 as a general calling channel, Channels 12, 7 and 5 for low power hand held units, Channels 16 to 23 generally SSB, Channels 15 to 1 generally AM. This being only a guide depending on the Channel occupancy at the time a station wishes to operate. The general calling and emergency Channels would be the only ones set aside by regulations, others would suggested only.*
6. **Limited licencee holders should be permitted use of the 27 MHz band**
   (a) *There is no common frequency band at present on which novice, limited and fully licenced hobbyists can meet together.*
   (b) *The limited licencee represents a section of the total amateur resource which can join in assisting the newly licenced communicator licencee.*

   The International no morse requirement for amateur operation on frequencies above 144 MHz has been dropped to all frequencies above 52 MHz in Australia, it should therefore be possible to further drop the no morse requirement to frequencies above 26.960 MHz.
7. **Third party restriction in relation to amateur community service activities should be removed.**

   International regulations state that the third party restriction on the amateur radio service can be wavered by the national administration. In the United States the amateur radio service has never had community service third party restrictions and this has encouraged the individual American amateur to employ his interest in the hobby in radio communication in the direction of worthwhile pursuits such as community service activities of all kinds.

   In Australia there is little community service activities in which the individual amateur is able to offer his skills to his community unless it is in an emergency or special permit condition. This situation is directly due to the total third party restriction on the amateur radio service in Australia. Much of the daily activities between amateur radio and the community which make up the amateur radio service in the United States as well as much of the unlicenced community service activities conducted by Citizen radio operators could not exist in Australia under the present total restriction on third party traffic. This restriction has the direct effect of discouraging a wider involvement between the amateur and the daily working of his community and as such should be re-examined with a view of modifying Australian amateur third party restriction.

   In the United States third party activities are restricted in the amateur service in two ways. Paragraph 97.114(b) of the FCC rules prohibits amateur radio communications that involves material compensation, either tangible or intangible, direct or indirect, to a third party, a station licencee, a control operator, or any other person and Paragraph 97.114(c) Third party traffic consisting of business communications on behalf of any party is prohibited (QST Magazine November 1976, page 66) That is third party restrictions involving community service activities by the American Radio Amateur is non existant so long as no material compensation of a peculiar nature exists.
8. *The two year tenure on the novice licence should be removed so as to encourage communicator licencees to study for the novice level examination which would permit equipment experimentation, more frequencies and more power.*

   Comment: The American novice licence tenure has been removed and is now renewable. (QST January 1977 page 86).
9. *Novice licencees should be permitted use of 28.1 to 28.2 MHz which has been allocated to novice licencees in the United States and soon in Canada as well as 28.5 to 28.6 MHz which is the portion where most contacts are initiated in the 10 metre band. These new allocations would provide the novice operator with additional operating flexibility especially during times of crowded conditions on the 27 MHz band.*
10. *Novice licencees should be permitted use of variable frequency oscillators (VFO). In the United States novice licencees are no longer required to be limited to crystal oscillators and are allowed use of VFOs, this recognises the fact that most novice operators are using commercial equipment for crystal oscillator operation makes little practical sense.*
11. *In the United States all classes of amateur operators who operate on the novice bands were, from last year limited to the novice power level, this could be made the case on 27 MHz if this were found to be necessary.*
12. *Removal of the age limitation on the granting of full and limited licences to encourage novice and communicator licencees to study for the full and limited examinations.*

    Comment: There has never been an age limit on any class of amateur licence in the United States.

The rest of the CARM submission goes on to discuss examination and licensing requirements of their proposals, NCRA-WAI affiliation, examination and licensing procedure, Interference and enforcement of regulations etc. On the licensing requirements they suggest that there be no tenure on a licence, no age limitation for prospective licencees and no morse code requirement. They argue that examination and licensing for a communicator class amateur licence could be carried out by authorised bodies such as the WIA and NCRA. These two bodies could possibly oversee regulation enforcement it is suggested.

The ACT Division of the WIA

The ACT Division of the WIA have made a submission similar to proposals from other WIA divisions. This submission examines some issues not considered by other submissions. It briefly dicusses the question of the electromagnetic spectrum as a resource, international radio agreements possible exploitation of the spectrum along with their view of current activity on 27 MHz.

The summary from their submission and their recommendations are reproduced below:

SUMMARY

In brief the submission recommends consolidation of existing provision for legitimate operators, in particular those using the 11 metre band, and the provision of a Very High Frequency (VHF) alloction for others presently termed Citizen Band Operators (CB'ers).

In the body of the report three main issues are dealt with:

(i) *the need to avoid pollution of the electromagnetic spectrum;*
(ii) *a moral obligation to limit Australian use of internationally agreed frequency allocations to the most justifiable uses;*
(iii) *a more objective look at the present claims for the need to establish CB radio in Australia.*

RECOMMENDATIONS

(i) persons wishing to make radio their hobby should take advantage of the present provisions for licensing in the amateur radio service;

(ii) the present provisions for genuine and/or essential users of the 11 metre band continue and, if necessary, be extended;

(iii) provision to be made in the upper VHF or lower UHF region for operators who do not have the necessary expertise to understand the operation of their equipment:

(iv) present legislation be amended to provide for stricter controls on sales of transmitting equipment. In particular, that retailers should only be permitted to sell transmitting equipment to purchasers who are in possession of a licence as suggested in (i) to (iii) above.

Basically, this submission supports options one and three from the P&T report. However, they make radically different proposals to those made by CARM which stem from the same two options. This submission suggests that the non-hobby users be allowed access to the 27 MHz band by expanding the existing provisions and putting the non-technical hobby users up on VHF or UHF. Somehow, with this proposal I fear the pirate problem would largely remain, even if further import or sales of 27 MHz equipment were severely restricted. To have any show at all, such a proposal would have to be 'phased in' by requiring currently active and prospective CBers to change to UHF equipment within a set time limit for example. It's a possibility but a lot more remote than the proposals put forward by CARM for example.

No matter how plausible or desirable recommendation (i) of this submission appears, it is the inequities and lack of applicability to the situation that reduces the attractiveness of attempting attempting to take advantage of the existing amateur licensing structure.

Regardless of prejudices and past requirements, knowledge of morse and morse operating procedures is really a non-essential skill, which the CARM submission pointed out.

The Federal Executive of the WIA

The Federal Executive of the WIA presented their submission, as being that from the WIA as a whole, in a letter to the Minister in late February. The relevant portions of this letter are reproduced below.

This submission deals largely with the regulatory and licensing provisions of a possible CB service rather than with proposals on frequency, licence structure, equipment provisions, etc. The tone of the submission is heavy on negative aspects. However, paragraph 5 of the submission balances this somewhat by recommending least delay in considering the CB question.

Five of the seven relevent paragraphs deal more with the WIA's 'position' in regard to the CB service. An interesting way of looking at things!

This Institute, consistently and for as long as it has existed, has been concerned about illegal operations within the Amateur Service frequency allocations. These may be caused by intruders or pirates or by any other unlawful or unauthorised activity within Australia or emanating from any other country and affecting the lawful use of those frequencies here.

The illegal use being made of the Australian Amateur Service 11 metre band shared allocation (26960 to 27230 kHz) by unlicensed operators in recent times is of concern to this institute.

The Institute believes that as these illegal operators are demonstrating a need for personalised communications for the public it is essential that this need should be seriously considered without unnecessary delay. The three options set out in the Report are considered to be useful for discussion purposes but should not eliminate the necessity for considering such other variations as would satisfy international obligations, accepatble administrative methods of regulation and control and the removal of illegal operators from spectrum usage.

If a "CB" service is to be introduced into Australia this Institute, in common with other interests representing users of the frequency spectrum, has no option but to insist upon the following paramount priorities —

proper and effective control measures must be observed and enforced at all times;

(b) the detection, apprehension and conviction of illegal stations and oeprators must be vigorously pursued both now and at all future times; and

(c) adequate compensation is necessary if any existing Amateur Service allocation is withdrawn or reduced, or rendered virtually unless for ordinary amateur communication purposes.

This Institute commends for the most serious attention those parts of the Report relating to the numerous problems experienced in the USA and elsewhere on the operations of the CB services in those countries. It should be added that as Amateur Serivce licences were suspended in the public interest during the two World Wars any intended "CB Service" must also be capable of being closed down on immediate notice. Any deployment of manpower to achieve this objective at a critical time should receive consideration.

The Institute also wishes to set out what may be termed secondary considerations relating to the introduction of any new or expended service. These are —

(a) real and potential interference to other services, equipment and facilities;

(b) the unlawful use of equipment for overseas communications;

(c) the ease of converting existing equipment for use on other adjacent, close or related frequency allocations;

(d) the exercise of intelligently administered controls over the importation and/or acquisition of equipment for any new or expanded service; and

(e) the establishment of any new or expanded service should be so designed as to create the minimum diversion of staff.

These considerations relate in general to technical criteria. Both (a) and (b) as well as (d) have received mention in the Report. In relation to (e) the relevance of paragraph 51 of the Report must be noted particularly as Amateur Service affairs have been accorded such as low priority for some years because of the staff situation within the Department. All offers of help by the Institute in specific areas have also been consistently rejected although consistently reaffirmed.

It is the considered view of this Insitiute that a service for a "CB" type of operation could be evolved which meets all the priorities listed in paragraph 6 above and most of the considerations outlined in paragraph 8.

If a decision is reached in favour of establishing any new or expanded service it is recommended that a technical committee should be appointed to determine the essential parameters, specifications, limitations and controls. It would be the wish of the Institute that it should be officially represented on such a committee.

Looking at SUBMISSIONS ON CB

The NCRA

The NCRA presented a petition to the Minister which is reproduced here:—

PETITION

To the Honorable the Speaker and members of the House of Represen-- tatives in Parliament assembled. The petition of the undersigned respectfully showeth that a Citizen Radio Service should be introduced on the 27 MHz frequency band incorporating frequencies 26.965 MHz to 27.255 MHz enabling use of good quality 23 channel AM and AM/SSB radio equipment currently available on the Australian Market. There shall also be additionally an extension of this service provided for in the VHF/UHF spectrum within 3 years as the usage of the Citizen's Radio Service increases. Your petitioners most humbly pray that the House of Representatives in Parliament assembled should, immediately introduce legislation to amend the Wireless Telegraphy Act and regulations to allow such a Citizen's Radio Service to function legally. These amendments should allow the Service to develop to the benefit of the people and also allow self regulation through the National Citizen's Radio Association as the united representative body of Citizen's Radio Operators working in conjunction with your Department Representatives, and your petitioners, as in duty bound, will ever pray.

That's pretty specific about what they want. It's a mix of options two and three from the P&T report, with a US-style, 23 channel, 27 MHz service to be introduced immediately and a VHF/UHF service to be phased in later to cope with increased demand. They propose self-regulation, as did the CARM submission, and this seems to be a popular idea.

COMMENTS

Well, submissions from the Amateur camp seem to go in for philosophy, conservation and regulation while those from the CB camps seem to go in for liberty, equality and fraternity

From the NCRA petition, CARM, and the local grapevine, it seems that self-regulation of a CB service is a popular idea amongst CBers. The example of the 'club clean-up campaign' is often cited in support of this idea and it even rates a mention in the P&T report (para 51).

I think, however, that with the potentially enormous numbers of CBers the scheme would break down. Under such circumstances, the actuality of self-regulation would be akin to masturbation — nothing but a pleasant self-delusion.

On the other hand (oh, sorry about that pun!), any regulations need not be unnecessarily harsh or potentially unenforcable.)

Most people support some minimal licence examination system and this is reflected in the submissions. There is widespread demand to retain the 27 MHz allocation in some form. CBers have already made some investment in 27 MHz equipment, and this fact is also reflected in the submissions.

Ideas on what controls and regulations should be introduced vary widely — everything from the benovelent particularly in the USA, that either adequate and detailed controls are placed on a CB-style communications service or the lecence structure should reflect what actually goes on — within limitations of technical, legal and international requirements.

COMING UP IN CB AUSTRALIA VOL 1 NO 5. . .

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These are our plans at the time of going to press . . . in the light of the uncertainty of CB in Australia we might have to postpone this survey to bring you more topical stories.

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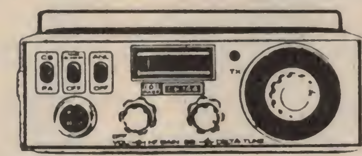

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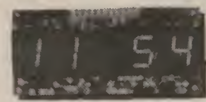

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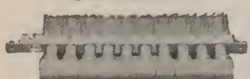

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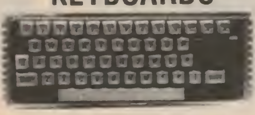

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PLA-4	Adaptor for PL-259 plug. for 75 ohm cable	31
SO-239	Panel Socket with flange. suit PL-259	$1.25
SO-239/A	Panel Socket without flange suit PL-259	98
PL-258	Cable joiner. double female. suit PL-259	$1 25
M-258	Cable joiner. double male. suit SO-239	$1 65
M-358	Cable joiner. "T" Connector (Double female and male)	$3 90
L-258	Lightning Filter and Arrestor (PL-259 plug to SO-239 socket)	$4 75
D-258	Dummy Load-with indicator lamp for transmitter power of 5 watts. 50 ohms impedance. PL-259 plug	$3 00
PC-258	1 metre Cable Assembly — RG 58/V cable with PL-259 plug each end — suit SWR and other test meters etc	$4 30
MP-4	CB 4 pin microphone plug	$1 50
CC-2	Mic Cable-3 conductor. single shield curly-cord. colour black	$1 75
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CB & THE LAW

Stephen Wagstaff looks at the laws relating to the use of CB gear by unlicensed operators.

UNFORTUNATELY CB RADIO has not yet been legalised in Australia. We know that anyday now the legislation for the introduction of a CB service should appear before the Federal Parliament.

What happens in the meantime?

The Wireless Telegraphy Act, 1905-1973, Section 6, sub section (1) (A) and (B), says "Except as Authorised by or under this Act, no person shall (a) establish, erect, maintain or use a station or appliance for the purpose of transmitting or receiving messages by means of wireless telegraphy or (b) transmit or receive messages by wireless telegraphy.

"Penalty: one thousand dollars, or imprisonment for five years." (Sub section 1 amended by No 93, 1966, S3, and No 216. 1973).

Currently there are increasing numbers of prosecutions under the above law with the offenders being fined various sums of money and having their equipment forfeited "for the use of the King".

The reasons why these prosecutions are occuring on the brink of possible legislation leaves me puzzled. A large section of the community is openly breaking the above law and is doing so in a manner which leaves the offenders open to detection. The Radio Branch have informed me that they are not relaxing in the constant vigil of

detecting offenders and in taking them before a court of law.

What makes the Radio Branch pick particular individuals for prosecution – what attracts their attention? A CBer may have been reported to the Radio Branch by another citizen who was having interference problems; he may have been reported in an official manner by an enemy or a person who doesn't like CB operators; he may have been using "bad" language on air and have been monitored by the Radio Branch; or in the investigation of an other matter his CB operations have come to the notice of the law enforcement officers.

On page 18 (paragraph 57) of the CB report released by the government it states that an average CBer runs a 'slight' risk of being caught.

The NSW Law

Any member of the radio branch, Commonwealth Police or the NSW police is empowered to take action against a CBer. The NSW Police are empowered under Section 8A of the Commonwealth Crimes ACt. They do not have to issue a receipt for any equipment that they confiscate as it is recorded in the evidence book at the local police station. They are empowered to enter your vehicle without a warrant to seize your equipment.

If necessary a police officer can arrest you without a warrant if the police find you in the act of committing an offence. If you resist a lawful arrest, the police can use necessary force to arrest you. You are advised not to offer any resistance, for if the arrest is lawful you render yourself liable to the offence of assaulting, resisting, or obstructing a constable in the execution of his duty.

Police may enter your premises without a warrant to effect a lawful arrest but they cannot enter your premises without permission just to question you. They cannot search your premises without your permission unless they have a warrant.

If the police enter your premises to effect an arrest they should not search the premises unless they have a search warrant. As a rule, if you consider yourself innocent of the charge do not make a statement until you have consulted a solicitor.

However, you are required to tell the police your name, date of birth, and address.

The Wireless Telegraphy Act

According to the Wireless Telegraphy Act (Section 6, Sub Section 1A) you cannot establish, erect, maintain or use any appliance for the purpose of transmitting or receiving messages by means of wireless telegraphy. The words "establish", "erect", "maintain" and "use" are hard to define in legal terms.

In the recent case in Bankstown, (Police v Wagstaff, 18.2.77, File No 297/77), the police were asked to define the word "maintain". They couldn't do so. The Police witness (a member of the Radio Branch) could not give a legal definition of the word "maintain". The onus was put on the magistrate to define "maintain". He used a dictionary to obtain his definition and the one he chose implied that maintenance is the same as possession.

If you have been following the court cases, you will have noticed that various courts put different interpretations on the same law. With these differing opinions it is no wonder that the police and the government authorities will welcome a decision on CB in the near future.

Should the law be reappraised

On page 18, paragraph 55, of the CB report it says the law should be reappraised. A situation exists in Australia where we have so many people openly breaking the law, on many occasions defying the authorities to catch them, so it is no wonder that the government would welcome new laws. It has now taken the first step (see page 17, paragraph 52, of the CB report) and has stated that the law is under review. It is up to the CBers to try and work together in the battle to legalise CB. This can be done by peaceful protests and demonstrations. Australians for many years have held such demonstrations to bring to the notice of the government situations which they think should be reappriased. Many have succeeded.

Until Australia gets a CB service, remember that if you use CB for hobby purposes you are breaking the law and you leave yourself open to harsh penalties.

References

(a) The Wireless Telegraphy Act 1905-1973.

(b) "Your Rights" by John Bennett published by the Council for Civil Liberties.

(c) Commonwealth Crimes Act.

(d) Court papers Police v SG Wagstaff. 18.2.77 file No. 297/77.

(e) CB Report released early in 1977 by the Australian Government.

ANY OPINIONS EXPRESSED IN THIS ARTICLE ARE THE PERSONAL VIEWS OF THE WRITER AND ARE NOT NECESSARILY ENDORSED BY THE MAGAZINE.

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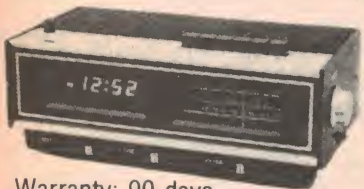

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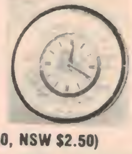

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22 µFd	10 p.c.b.	10c	8c
22 µFd	50 p.c.b.	17c	15c
25 µFd	16 p.c.b.	10c	8c
33 µFd	6.3 p.c.b.	11c	9c
33 µFd	16 p.c.b.	12c	10c
47 µFd	10 p.c.b.	14c	12c
47 µFd	25 p.c.b.	16c	14c
47 µFd	50 p.c.b.	17c	15c
100 µFd	10 p.c.b.	16c	13c
100 µFd	25 p.c.b.	18c	15c
220 µFd	6.3 Axial	20c	17c
220 µFd	16 p.c.b.	20c	17c
220 µFd	35 p.c.b.	26c	22c
470 µFd	6.3 Axial	25c	22c
470 µFd	25 p.c.b.	25c	22c
			10 up
1000 µFd	10 Axial	38c	35c
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4013	1-00	90
4014	2-25	2-05
4016	85	75
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4018	2-50	2-25
4021	2-30	2-10
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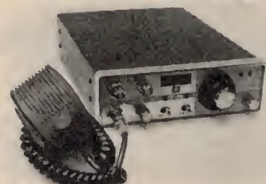

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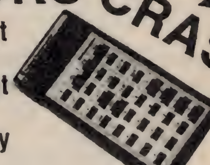

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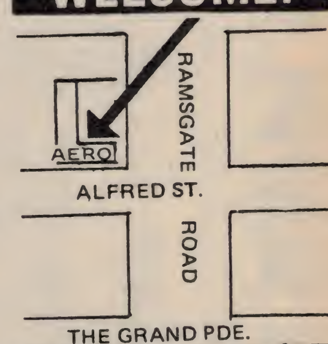

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¼ wave high efficiency ground plane, solid 108 inch heat treated radials and radiator. Radials droop for 50 ohm match. Complete with S0239 socket. $35 + P&P $3

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Covers a frequency range 2-200MHz, this handy little meter enables each checking of antenna radiation. $8 + P&P $1

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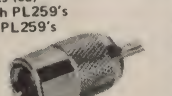

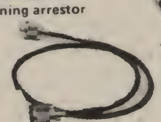

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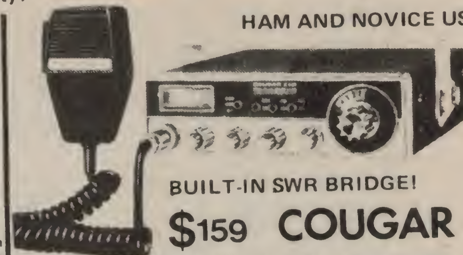

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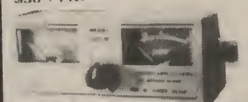
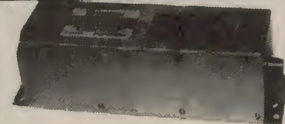


$36 SWR/PWR METER

TVI FILTER



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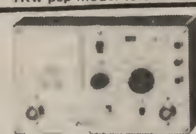

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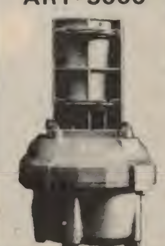
AIGA ROTATOR SPECIFICATIONS SUMMARY

MODEL NO.	ART-8000	ART-3000A
Rotating Torque	2,500kg/cm	850kg/cm
Braking Torque	10,000kg/cm	1,700 kg/cm
Maximum Vertical Load	2,500kg	250kg
Control Accuracy	± 5°	± 5°
Drive Type	Gear	Gear
Power Requirements	(May be modified upon request)	
Operation Temperature	−40°~ +80°C	−40°~ +80°C
Forward/Reverse Delay	3 seconds	3 seconds
Maximum Continued OP	20 minutes	3 minutes
Mast Clamp	48 φ ~ 78 φ	34 φ ~ 55 φ
Cable Requirement	9 conductor	8 conductor
Net Weight	26kg	5.7kg
Shipping Weight	27.5kg	6.5kg

ART-3000



ROTATOR

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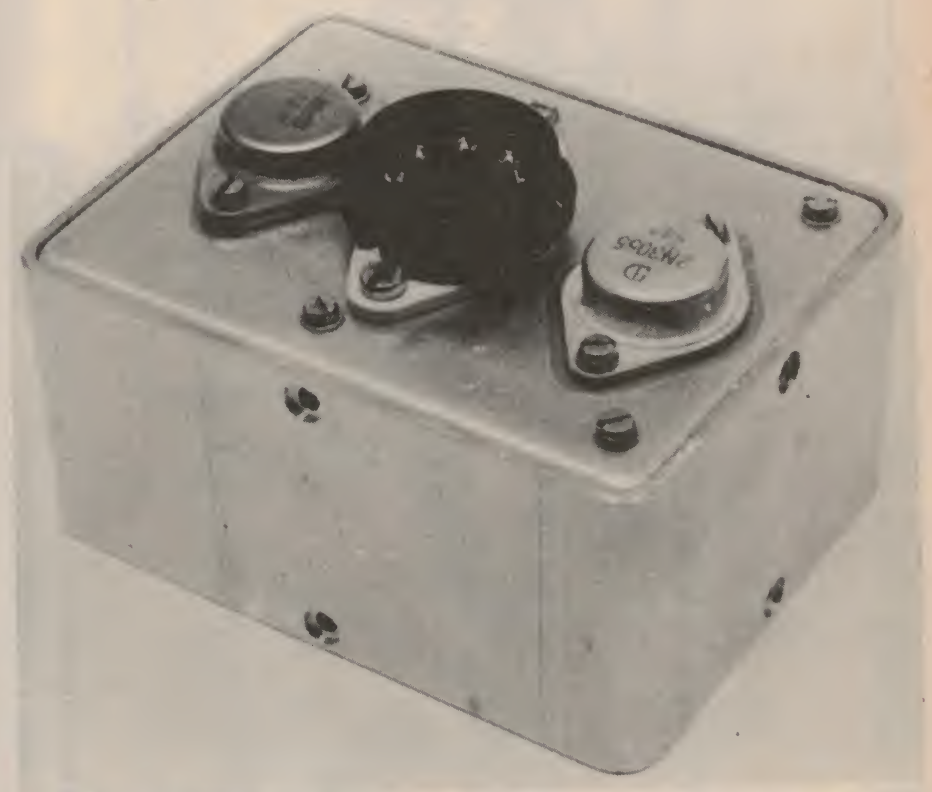
Project 316

TRANSISTOR ASSISTED IGNITION

A reliable type of electronic ignition which uses either the existing points in the distributor or home-made light-beam points.



THE MOST POPULAR project for use in a car must be some type of electronic ignition. The Kettering system (the one used on most cars) is as old as the car itself and has not changed much over the years. It still works by a set of points which close, to allow the current to build up in the spark coil, and then open so that the energy in the magnetic field of the coil is used to generate the high voltage needed to fire the plugs. The system has problems at high speed in that the current does not have time to rise to a high enough level before the points open — resulting in the output voltage falling as the speed increases. At low speed (when starting) the points open too slowly and some energy is lost in arcing across the contacts. The use of a ballast resistor (usually about 1-1.5 ohm) and a lower inductance coil helps the high speed performance and shorting the ballast resistor while starting helps.

While this system has performance limitations it is reliable. The points need to be cleaned every 10,000 km or so but the system is unlikely to suddenly fail without warning.

Electronic Ignition

Electronic ignition has been around for about 15 years, but until recently no major car manufacturer has used it in production. This is due not only to the additional cost but mainly to the reliability problems (how many NRMA men carry spare transistors?).

The first electronic ignition system simply used a transistor to switch the main current — giving longer points life. Unfortunately in those days a high voltage transistor could handle a maximum of about 150 V and special transformers (ignition coils) had to be wound and a large ballast resistor was needed. These normally consumed about 10 or 15 A from the battery.

Soon afterwards dwell extenders made a brief appearance and these used an SCR to close the points about 1 ms after they opened, giving a longer time for the current to build up. This helped the high speed performance but did not help starting or points life.

The main system, which has been around for many years is CDI, where the required energy is stored in a capacitor and when required it is dumped into the spark coil which is used only as a transformer (not for energy storage). This system is economical on power, is good at both high and low speed and has been most popular with the hobbyist.

Text continues on page 54

TRANSISTOR ASSISTED IGNITION

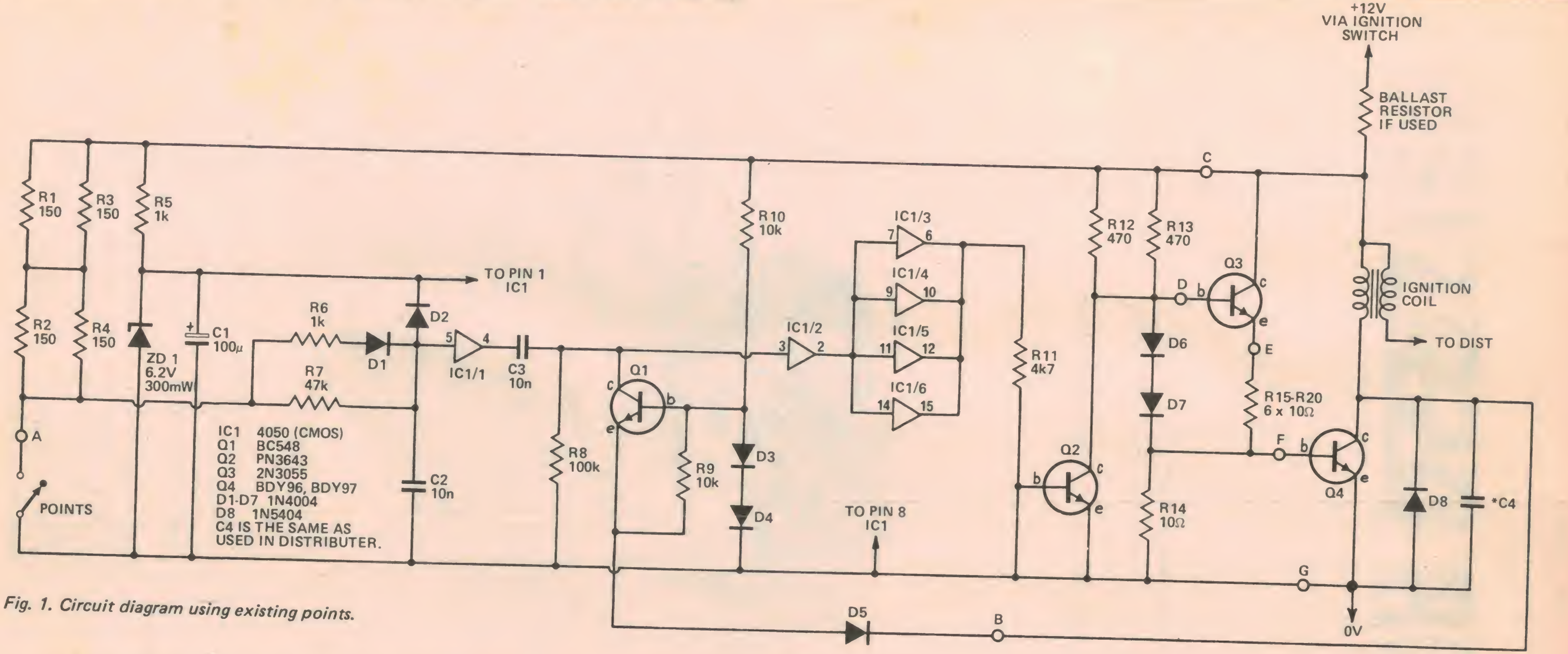


Fig. 1. Circuit diagram using existing points.

HOW IT WORKS ETI 316

The main current in the coil is switched by Q4 which is a 750 V 10 A transistor. The base current, of which about 500 mA is needed, is provided by Q3, which acts as a constant current source. We used this instead of a resistor as the supply voltage can vary from 6 to 12 volts (and the power dissipation would be too high). The current source is switched on and off by Q2 (the output transistor being off if Q2 is on). Diode D8 prevents reverse voltage damaging Q4 while C4 prevents the output voltage rising to high.

The points are supplied with a current, by R1-R4, of about 60 mA, which keep them clean, and when they open C2 is charged rapidly via R6 and D1. This is buffered by IC1/1 (IC1 is a CMOS hex buffer) which triggers the monostable made up of C3 and R8. This is then buffered by IC1/2 then by IC1/3-6 and this then controls the output stage. This will turn the output transistor off for about 1 ms (normal dwell) unless Q1 intervenes. This transistor operates if the output voltage falls to, or below, zero and resets the monostable, turning Q4 on again. This occurs after the first transient and ensures that Q4 is not turned on when there is high voltage across it.

When the points close C2 discharges more slowly via R7 and if the points open again quickly (ie, bounce) this is ignored. The supply voltage of IC1 is regulated by ZD1 and C1 to 6.2 V.

Construction

We made our prototype in a metal box — Horwood type 34/2/D. The two power transistors are mounted on the lid along with the changeover socket, capacitor C4, and the diode D8. All other components are mounted on the pc board which is mounted on 20 mm spacers.

The pc board should be assembled with the aid of the overlay in Fig 2. Ensure the transistors are oriented correctly — also check the diodes, IC1, and C1. The IC should be installed last. Mount the power transistors using insulating washers. The capacitor C4 should be the same type as used in the distributor. If desired it can be removed from the distributor and fitted on the coil itself, between earth and the negative terminal. In this place it will

work for standard or assisted ignition.

The external wiring can now be done according to Fig 2. Ensure that the outer surface of C4 is connected to the emitter of Q4. When mounting the pc board ensure that the spacers do not touch any of the tracks if they do use a piece of insulation under the end.

As the octal plug has to be capable of plugging-in in two positions, ie, standard or assisted ignition, the socket has to be modified slightly. This entails making a new slot between pins 1 and 2 similar to the one between pins 1 and 8. This can be either a new slot or the existing slot can be widened. There are three links required in the plug, these being between pins 1&8, 3&4 and 5&6. With the plug in the normal position standard ignition is selected and in the second position transistor assisted ignition is operational.

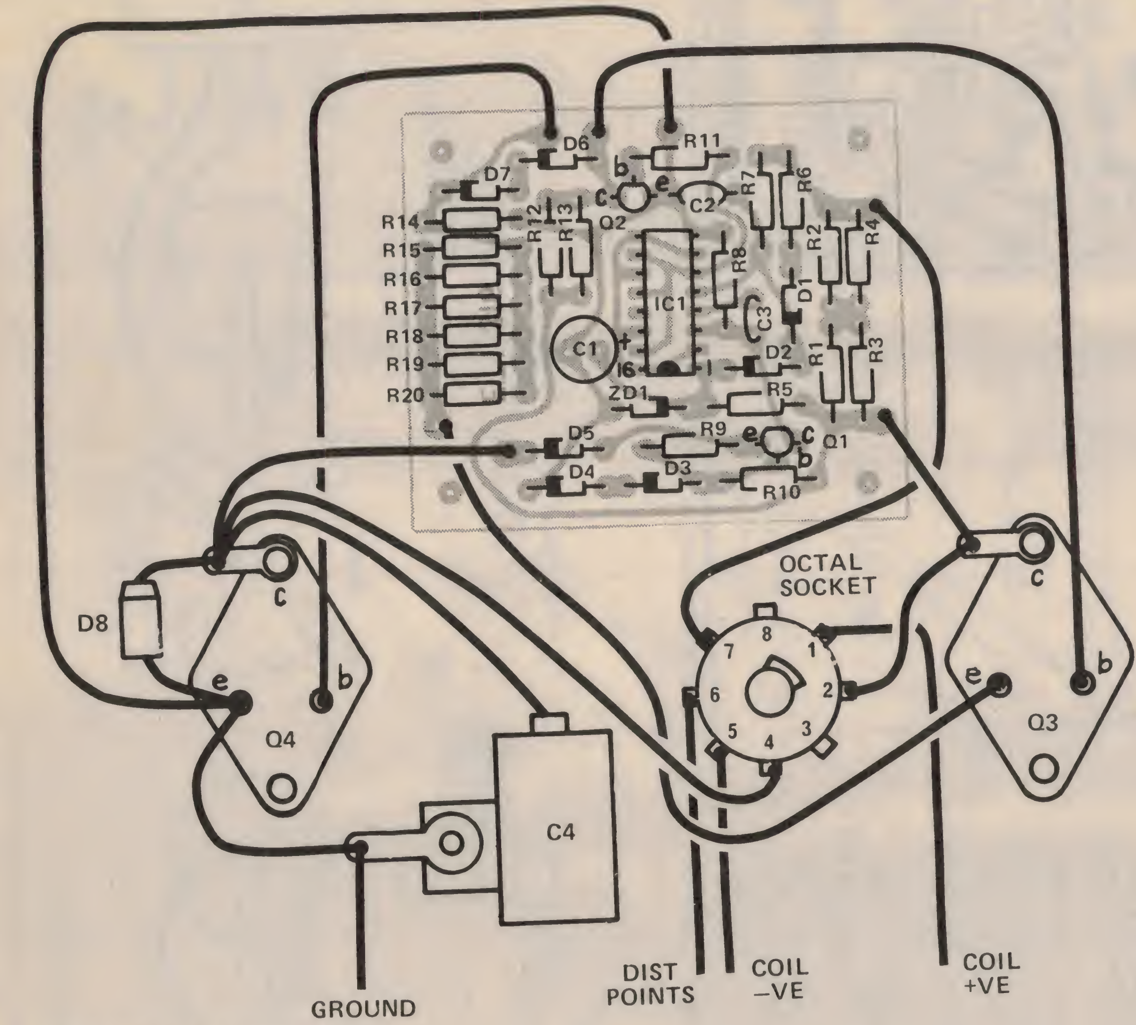


Fig. 2. Overlay and wiring diagram.

PARTS LIST — ETI 316

Resistors all ½W 5%		
R1-R4	150 ohm	
R5,6	1 k	
R7	47 k	
R8	100 k	
R9,10	10 k	
R11	4k7	
R12,13	470 ohm	
R14-R20	10 ohm	
Capacitors		
C1	100 μ 16 V electro	
C2,3	10 n polyester	
C4	see text	
Semi conductors		
Q1	Transistor	BC548
Q2	"	PN3643, 2N3643
Q3	"	2N3055
Q4	"	BDY96, BDY97
D1-D7	Diodes	1N4004
D8	"	1N5404
ZD1	Zener	6.2 V 300 mW
IC1	4050 (CMOS)	
Miscellaneous		
PC board ETI 316		
Case, Horwood 34/2/D or similar		
Octal plug and socket		
Four 20 mm long spacers		

Today many of the major car manufacturers are offering electronic ignition either as standard or as an option. These however are not (generally) CDI but types similar to the earlier transistor switch type (using modern high voltage transistors). Some systems also eliminate the points — using either an optical or magnetic pickup instead.

The system described here is a transistor switch type but with dwell extension built in. The unique circuit can provide a spark rate beyond that needed by most motors and will give a good spark at speeds which some CDI systems will stop. It is simple to install and we have provided a change-over plug (just in case you have problems). If required the points can be replaced by a light beam and optical pick-up (if you have the mechanical facilities to build them).

Design Features

When we decided to design a transistor assisted ignition we realised that no matter how it was designed there was a minimum cost.

The output transistor and the case are the major expenses and both are necessary. We therefore decided to see what other facilities we could add to make the project more worthwhile without making it much more expensive.

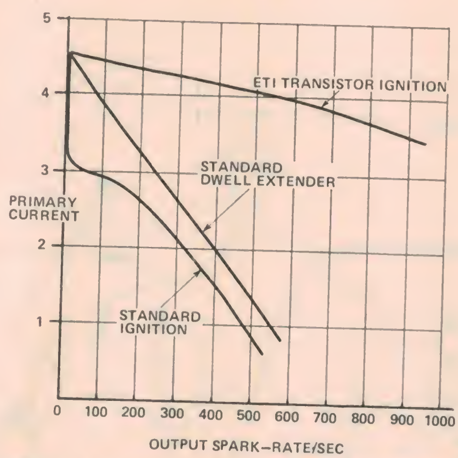
Adding dwell extension improves high speed performance but with the standard design method the voltage still falls somewhat at high speeds. After examining the primary waveform it was realised that when the points open that a lot of energy is wasted in ringing and that the spark only occurs in the first positive transient. It was therefore decided to try turning the transistor on after only this first transient. This immediately gave a more stable spark of higher energy and allowed very high speeds (over 1500 sparks per sec.) The primary current remains much more constant as the coil does not completely discharge each cycle.

LIGHT BEAM POINTS

The description given here is intended only as a guide — there is a large amount of mechanical work involved and there are a large number of different distributors around, so precise details cannot be given. We recommend that unless you are experienced in both mechanical work and electronics you use the existing points.

When using light beam points a disc is fitted over the cam (after removing the existing points) and a photo transistor and an LED are mounted on opposite sides of this disc. Slots are cut in the disc allowing the beam from the LED to either strike the transistor or to be masked by the disc. Both LED and transistor must be shielded to allow only a fine beam to pass between them. The width of the slot in the disc is not important but the edge which breaks the beam MUST be accurately positioned.

Before removing any part of the existing distributor slowly turn the motor until the points just open. Now mark on the side of the distributor the exact position of the rotor button. This is needed to ensure that when fitting the light beam points that the beam is just broken at the same point.



Graph showing relationship between average coil current and spark rate for the different systems.

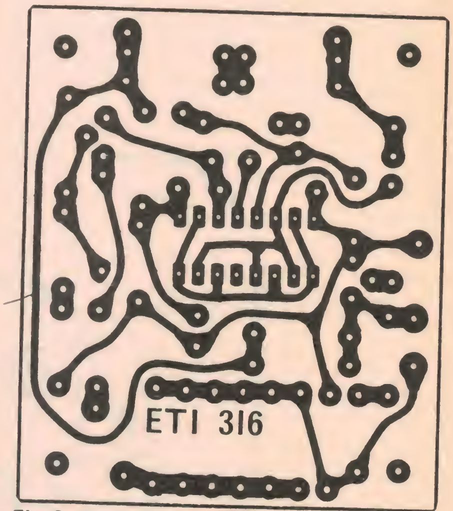


Fig. 3. Printed circuit board. Full size 65 x 55 mm.

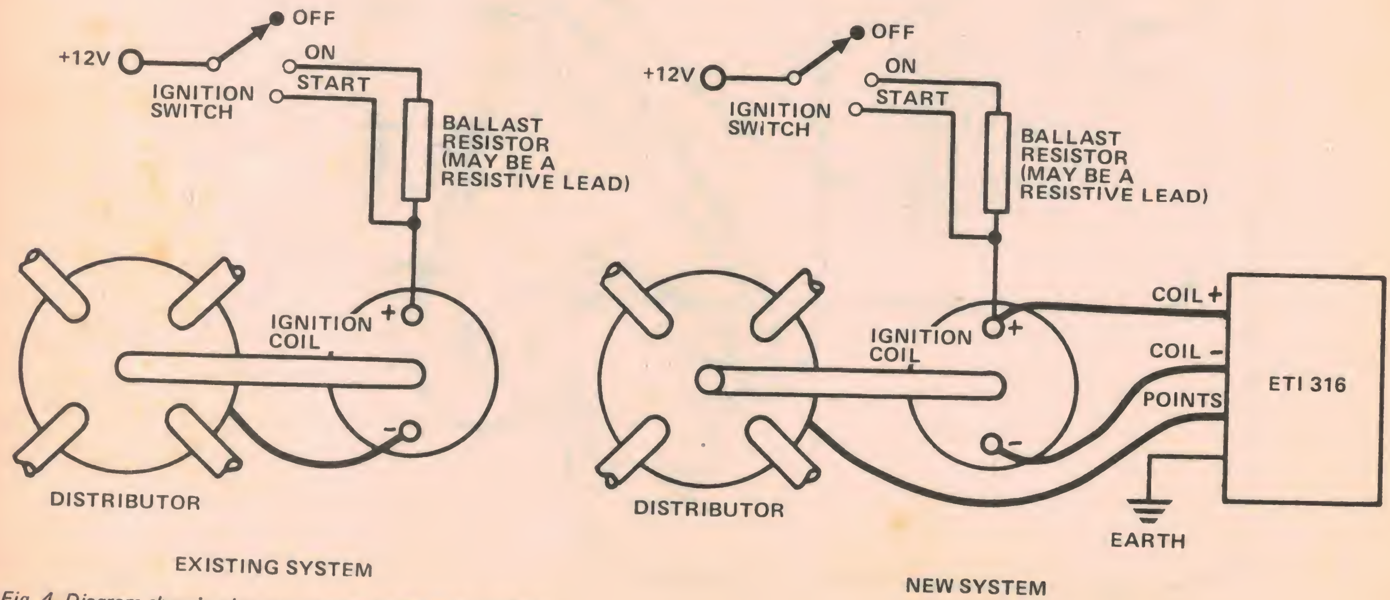


Fig. 4. Diagram showing how to connect the unit to the car.

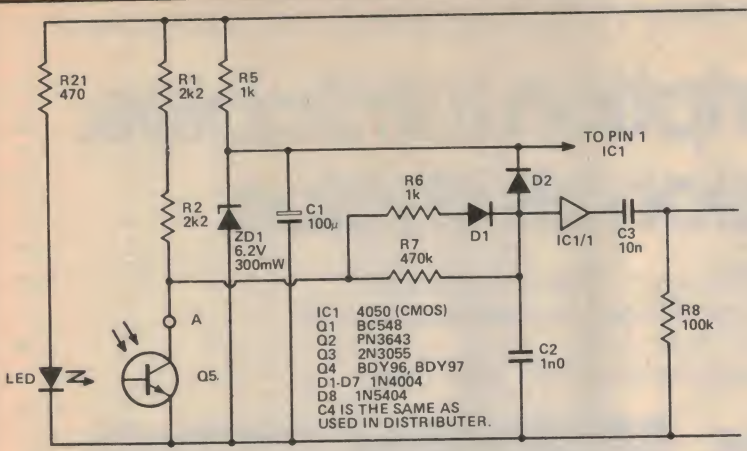


Fig. 5. Changes needed to the circuit to use light beam points.

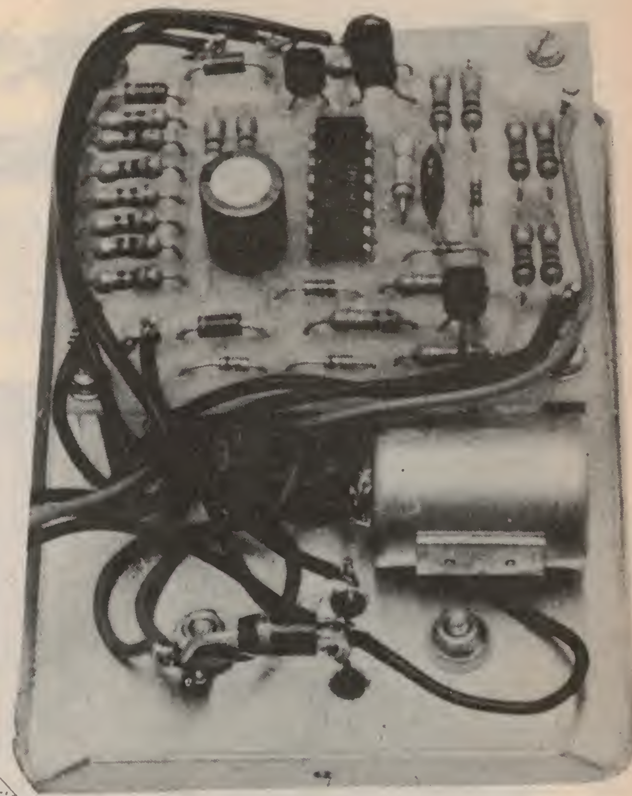
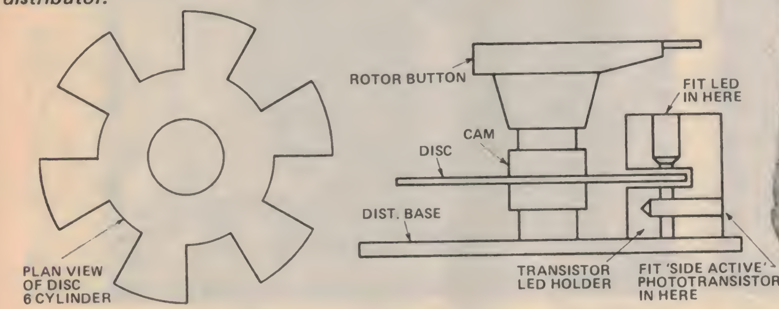


Fig. 6. Disc and LED-transistor holder shown mounted in a typical distributor.



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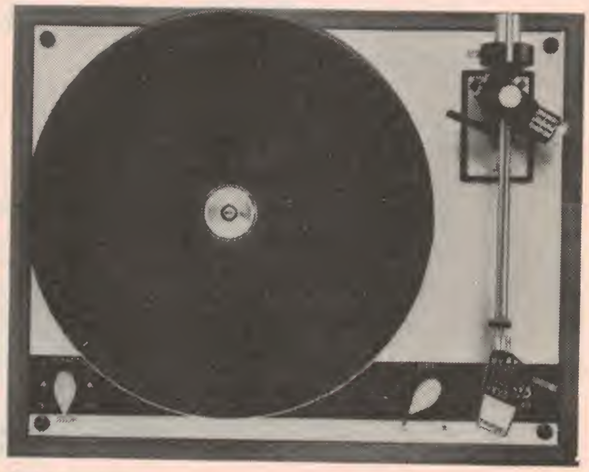

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12 VOLT 100 WATT AUDIO AMPLIFIER

This month we look only at the power supply. This unit is capable of driving two 50 W or one 100 W ETI 480 module.

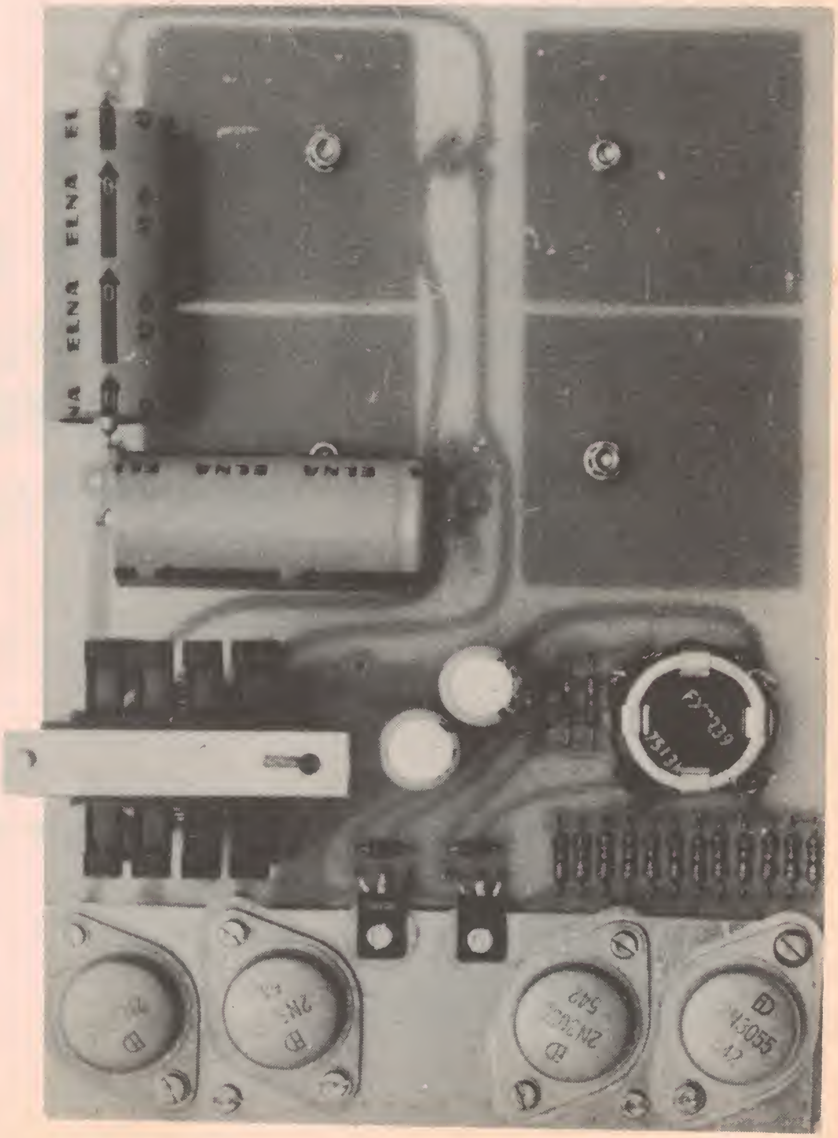
WE HAVE HAD requests from pop groups and car owners for a high powered amplifier which can operate from a 12 volt battery. Next month we will be describing a complete guitar-type amplifier which can be powered by either 12 V dc or 240 V ac. This month we will describe the 12 V converter which supplies ± 40 V. This is required by the ETI 480 amplifier module. This converter can handle either a single 100 watt or two 50 watt modules.

We have kept the converter's oscillator frequency above the audio band, and providing the unit is shielded (to prevent RF noise) there is no noise or interference from the converter.

When operating any amplifier off a battery supply, it must be remembered that the power consumption can be high. For 100 watts sinewave, the amplifier needs 150 watts input (assuming 66% efficiency) and with a converter efficiency of 80%. This gives an input power of about 180 watts. That's 15 A from a 12 V supply. With music waveforms this does, however, drop to 8-10 A but even this can quickly flatten a normal car battery.

Design Features

With an inverter of this power there are a number of problems to be solved at the design stage. The simplest type of inverter is the self-oscillating feedback type which also has the advantage that it is short-circuit proof. However, it usually operates at about 2 kHz and the noise generated can be annoying for audio use. This type can be made to oscillate at over 20 kHz but high speed transistors must be used (which are expensive).



We looked at the special ICs designed for use in switching-mode power supplies (a similar application) as voltage regulation. However, if normal transistors (2N3055) are to be used a complex control circuit is required to ensure the transistors turn off quickly enough to prevent overheating. The main requirement in turing the transistor off is that the base must be reverse biased. To do this up to one amp must be taken out of the base (only for about 2 μs) to reduce the storage time of the transistor. If this is done the 3055 will turn off in about 2 μs (where simply removing base current means a 5 μs turn off time).

The design finally settled on is a dual transformer type. This uses a low-power self-oscillating inverter driving the main inverter, using 3055s in parallel to handle the current. As high-speed low-power transistors are available (BD139) there was no problem in obtaining 20-25 kHz operation.

The other problem of operating at over 20 kHz occurs when you rectify the output. Normal rectifier diodes conduct for about 5 μs after being reverse-biased — this causes high power dissipation. We tried 1N4004 diodes at 1 A and they lasted about 30 seconds! High-speed diodes are available but they are generally expensive and/or on long delivery.

We finally settled on some Philips types (BYX71) which are reasonably priced and available (at the time of writing anyway). They are 7 A, 150 V devices, mounted on suitable heatsink, and they turn off in less than 0.5 μs, greatly reducing power dissipation.

To filter this frequency only small capacitors are needed, but due to the variable load of the audio amplifier (peak currents of about 8 amps) we used 1000 μF (to smooth the load and stop the high peaks overloading the converter).

TABLE 2

ALL RESULTS WITH 12.6V INPUT		
OUTPUT POWER WATTS	OUTPUT VOLTAGE VOLTS	INPUT CURRENT AMPS
0	80	1
1.5	68	1.1
25	67	3
50	65	5
75	63	7.2
100	61	10
125	59	12.5

TABLE 1 Transformer Winding Details

Transformer T1

Core 2 x FX2239 21 mm A5
Former 1 x DT2204
Clip 4 x DT2362
Ring 1 x DT2361
Base 1 x DT2364

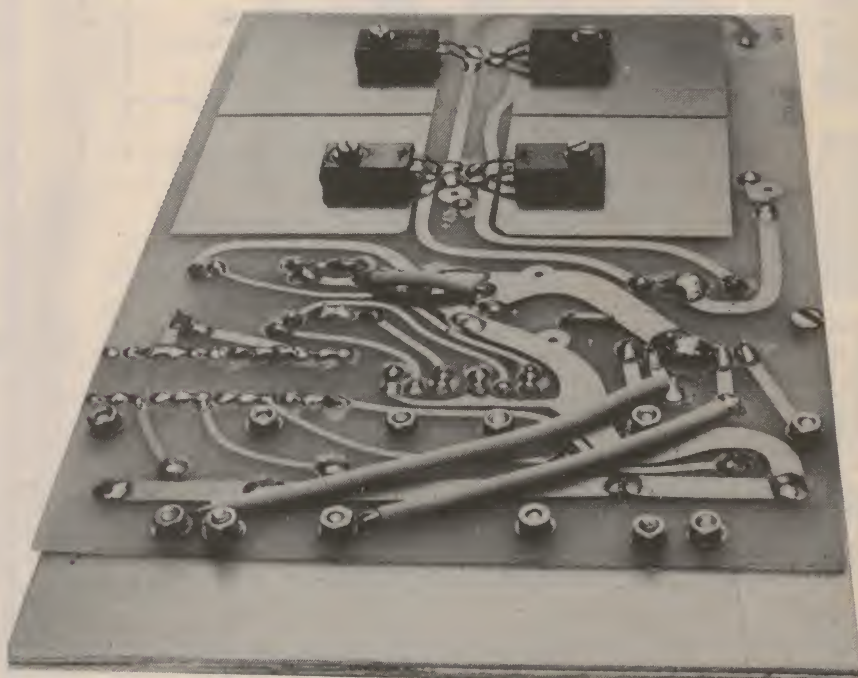
Windings	Start	Finish	Turns	Gauge	Notes
Sec 1	4	6	2	0.8 mm	Bifilar
Sec 2	6	5	2	0.8 mm	wound
Prim 1	2	1	8	0.5 mm	Bifilar
Prim 2	1	3	8	0.5 mm	wound
Feedback	8	7	5	0.5 mm	

Transformer T2

Core 2 x FX3730
Former 1 x DT2730

Winding	Start	Finish	Turns	Gauge	Notes
Prim 1			5	1.25 mm	
Prim 2	SEE OVERLAY		5	1.25 mm	QUADFILAR
Prim 3			5	1.25 mm	wound
Prim 4			5	1.25 mm	
SEC 1	SEE OVERLAY		16	1.0 mm	Bifilar
SEC 2	*		16	1.0 mm	wound

** Secondary is on opposite side to primary. All windings come out the one end. To allow the wires to come out at the one end the lugs marked 2,3,6 and 7 should be broken off on the former.*



12 VOLT 100 WATT AUDIO AMPLIFIER

NOTES:

Q1,2 BD 139
Q3 – Q6 2N3055
D1,2 1N4001
D3 – D6 BYX71 – 150
T1, T2 SEE TABLE 1

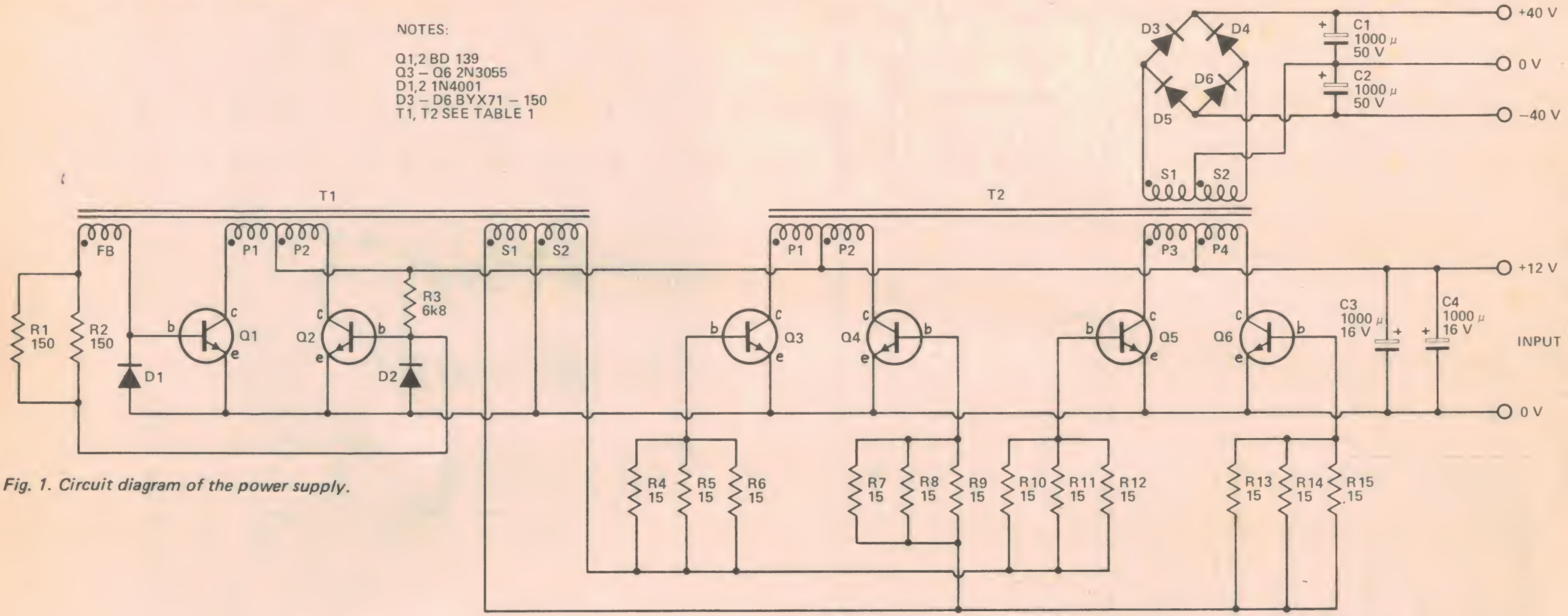
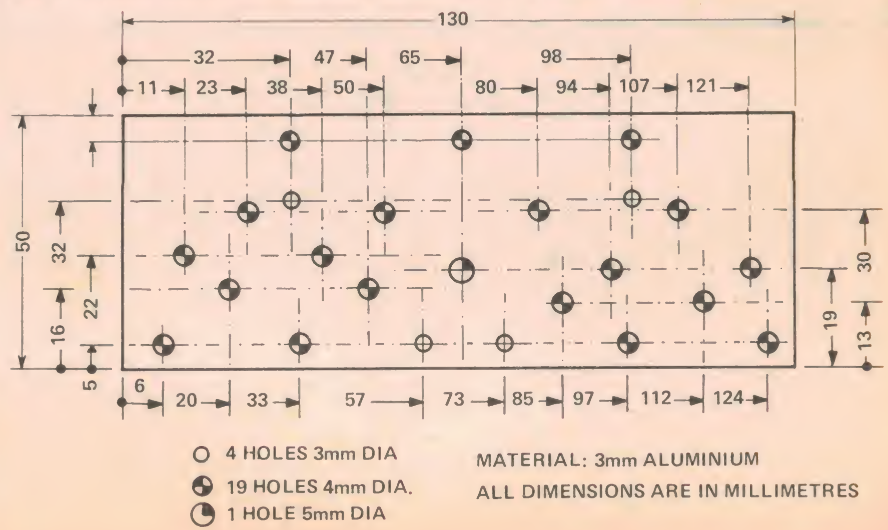


Fig. 1. Circuit diagram of the power supply.

Fig. 2. Heatsink bracket. The unit must be bolted onto a heatsink before use.



How it Works – ETI 481 PS

The transformer T1 and transistors Q1 and Q2 form a self-oscillating oscillator at about 25 kHz (with a 14V input). The secondary of this transformer is used to drive the base circuit of the main transistors, Q3-Q6. Resistors R4-R15 limit the current into the base to about 0.5 A. The transformer T2 has two primaries, each connected to separate transistors, providing the necessary current sharing. The secondary of T2 is rectified by D3-D6, which are high speed diodes, and filtered by C1 and C2.

When measuring the output voltage a minimum load of about 30 mA is needed. When driving an amplifier the quiescent current is enough to provide this minimum current.

PARTS LIST – ETI 481 PS

Resistors all ½ W 5%	
R1,2	150 ohm
R3	6k8
R4-R15	15 ohm
Capacitors	
C1,2	1000 µ 50 V electro
C3,4	1000 µ 16 V electro
Semi-conductors	
Q1,2	Transistors BD139
Q3-Q6	Transistors 2N3055
D1,2	Diodes 1N4001
D3-D6	Diodes BYX71-150
Miscellaneous	
T1	Transformer see Table 1.
T2	Transformer see Table 1.
PCB	ETI 481 PS
Heatsink bracket to Fig. 2.	

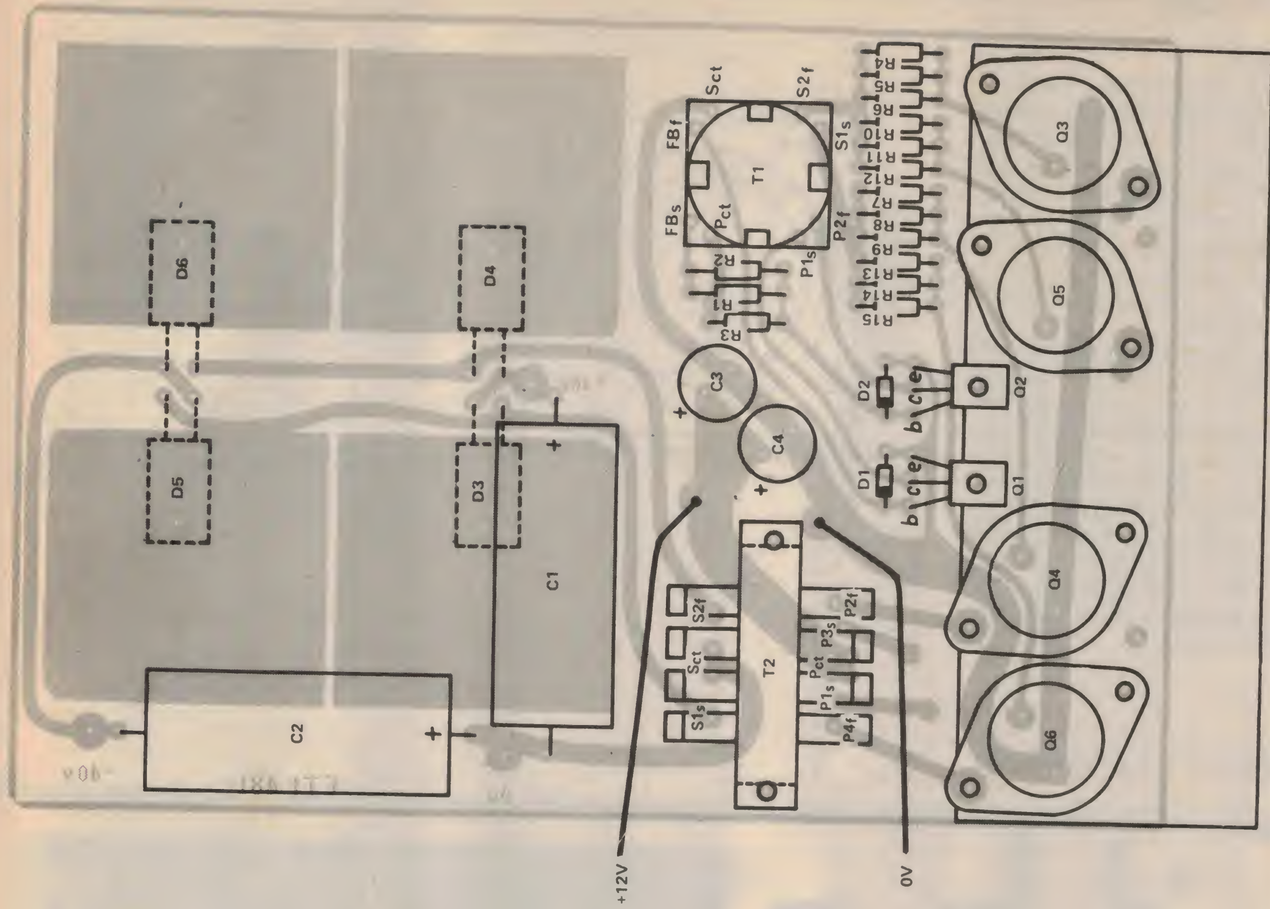


Fig. 4. Component overlay.

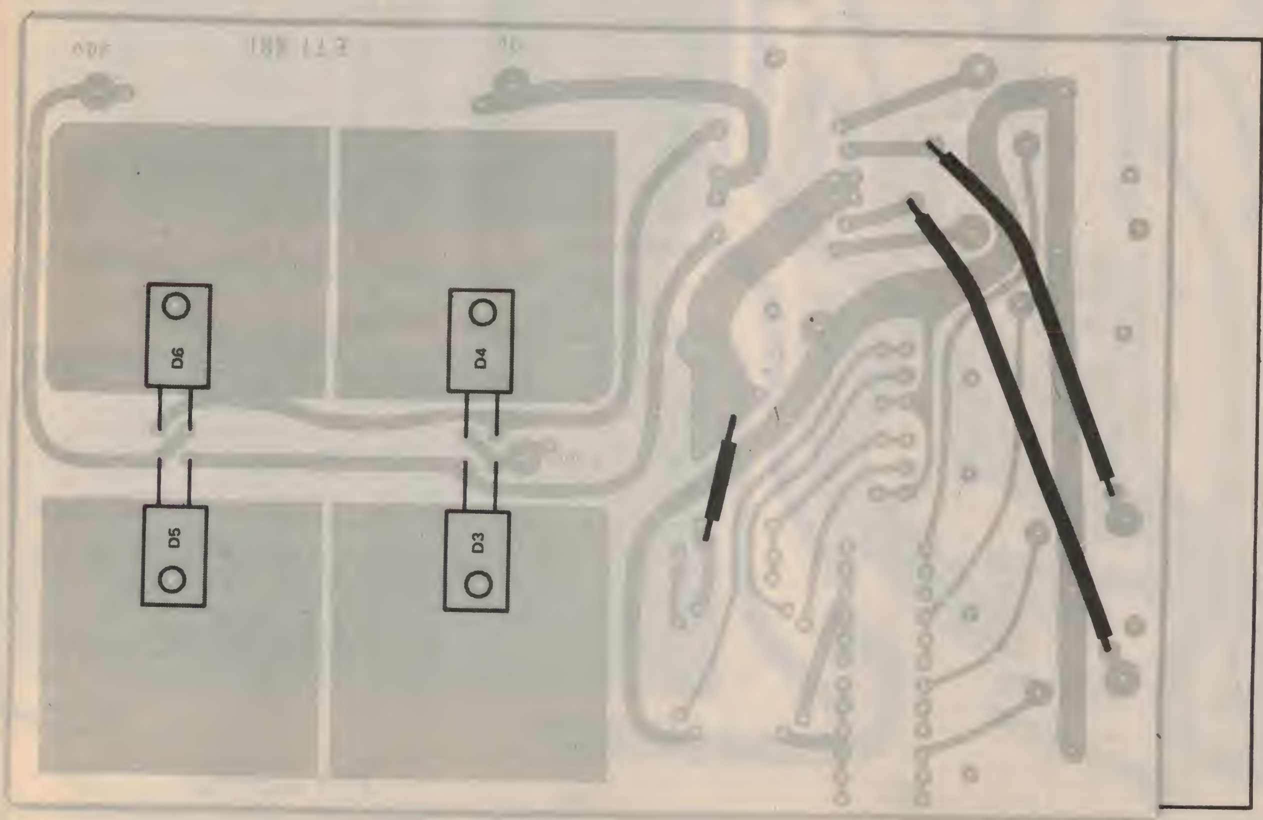


Fig. 3. Diagram showing position of the links and diodes D3-D6.

Construction

Except for the winding of the transformers, construction is simply assembling a pc board. If the transformers are not available ready-wound they can be made from the details in Table 1. Note that there are not many turns but they are wound using a reasonably heavy gauge of wire. One turn short or too many on one winding could damage the main transistors.

When assembling the pc board note that D3-D6 are on the copper side and the metal surfaces are bolted in contact with the pc board which then acts as a heatsink. Also there are a few links on the copper side of the board as it was not possible to get the tracks on the pc board wide enough to carry the currents.

The unit, when assembled onto the heatsink bracket, must be mounted onto a heatsink similar to the one used in the amplifier module.

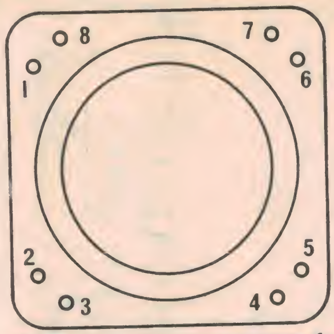


Fig. 5. The pin numbering sequence for T1.

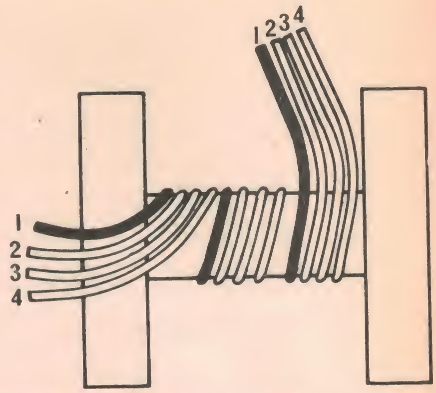
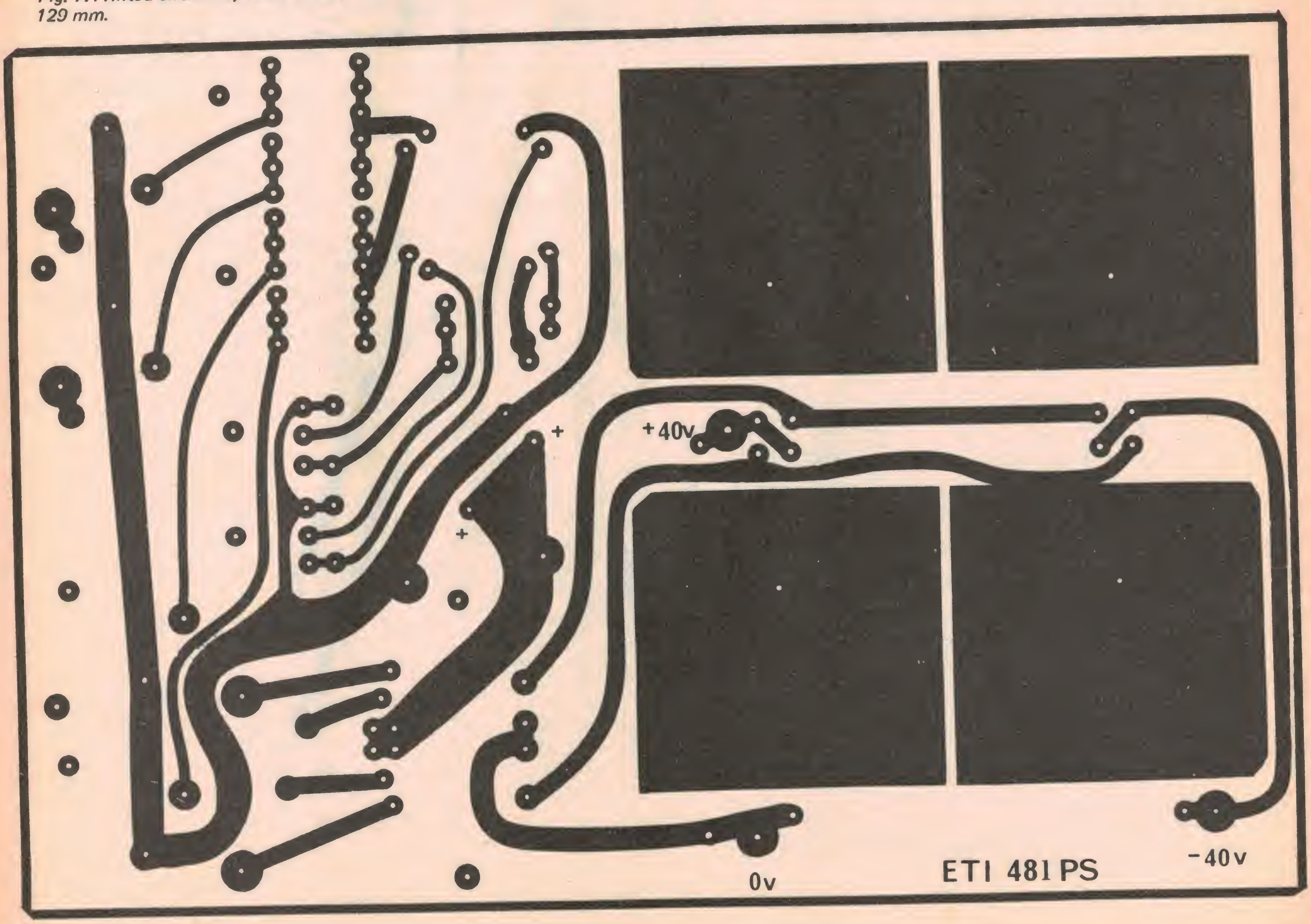


Fig. 6. Diagram showing the start of the quadfilar primary winding of T2. Note that it must be wound this way to reduce power consumption and improve regulation.

Fig. 7. Printed circuit layout. Full size 188 x 129 mm.



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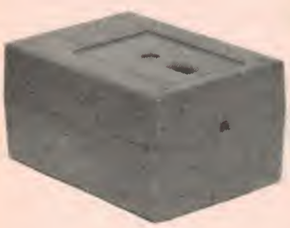
Colour: blue-grey, 2-tone.



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AC126	1.80	BC639	1.20	MPF103	.85	2N3054	1.70	2N5459	MPF105
AC127	1.80	BC640	1.20	MPF104	1.10	2N3055	1.35	2N5485	MPF106
AC128	1.80	BD131	1.20	MPF105	.65	2N3564	.65	2N5590	MPF603
AC132	1.50	BD132	1.60	MPF196	1.15	2N3565	.55	2N5591	11.30
AC187	1.50	BD139	1.20	MPF121	1.60	2N3566	.95	2N6027	1.35
AC188	1.50	BD140	1.20	MRF603	6.90	2N3568	.95	2N6084	21.00
AD149	2.60	BD237	1.80	TIP31C	1.20	2N3569	.50	BA102	.80
AD181/62	4.50	BD238	1.80	TIP32C	1.30	2N3638	.55	OA47	.60
AS322	.18	BD437	2.80	TIP120	3.20	2N3638A	.60	OA90	.35
AT118	2N301	BD438	2.80	TIP125	3.30	2N3642	.55	OA91	.35
ASY17	2.65	BF173	1.25	TIP141	4.70	2N3643	.55	5082-2800	3.20
BC107	.35	BF180	1.20	TIP2955	1.70	2N3694	.65	40440	2N3731
BC108	.35	BF194	.85	TIP3055	1.70	2N3731	5.95	40637A	2.85
BC109	.35	BF200	1.30	TT800	2N4037	2N3819	1.35	40673	1.95
BC177	.40	BFY50	1.20	TT801	1.20	2N3866	2.75	40822	2.90
BC178	.40	BFY51	1.50	2N301	2N2889	2N4037	1.25	40841	1.90
BC179	.40	BPX25	4.90	2N706A	1.20	2N4249	.85	BZX61	.75
BC182	.40	BSX19	.75	2N918	1.60	2N4250	.85	BZX70	1.50
BC212	.50	BU126	3.85	2N2222A	1.20	2N4355	.85	BZY91	12,50
BC327	.55	MFE131	1.95	2N2646	2.50	2N4358	.85	PA40	5.85
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BC547	.55	MJ2955	2.60	2N904A	1.50	2N5245	.75	MEL12	1.40
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With the 5 W stereo amplifier it was worse than that. On the day of publication we were told that the IC would not be available ever again! Fortunately National have re-released the LM379 but in a different package (it appears that the physical package and not the IC chip was the problem).

We have therefore redesigned the pc board to accommodate the new IC (LM379 S). We are also describing a small interface board to allow a new IC to be used on an original board.

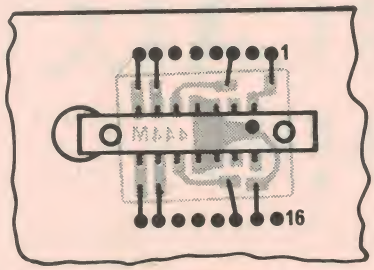


Fig. 2. Component overlay showing how the small board is connected.

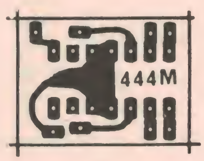


Fig. 3. The printed circuit layout of the small board which allows the LM379S to be used on the origional board.

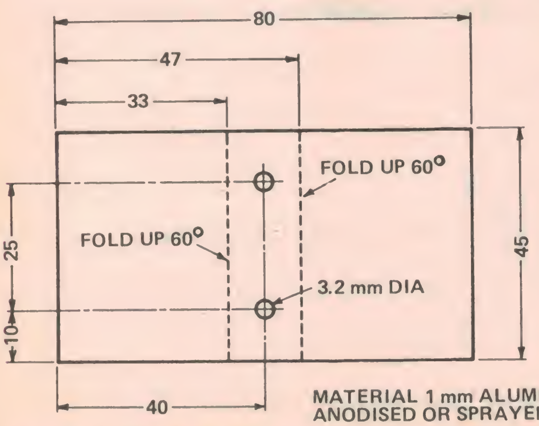


Fig. 1. The heatsink needed for the LM379S.

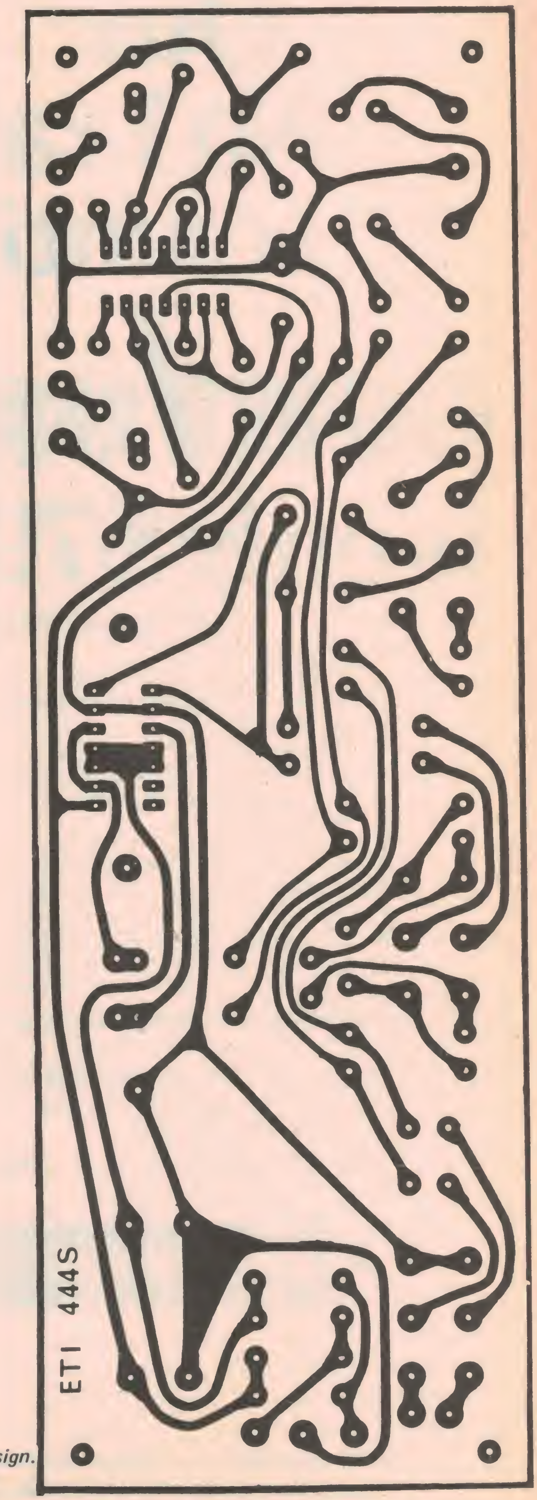
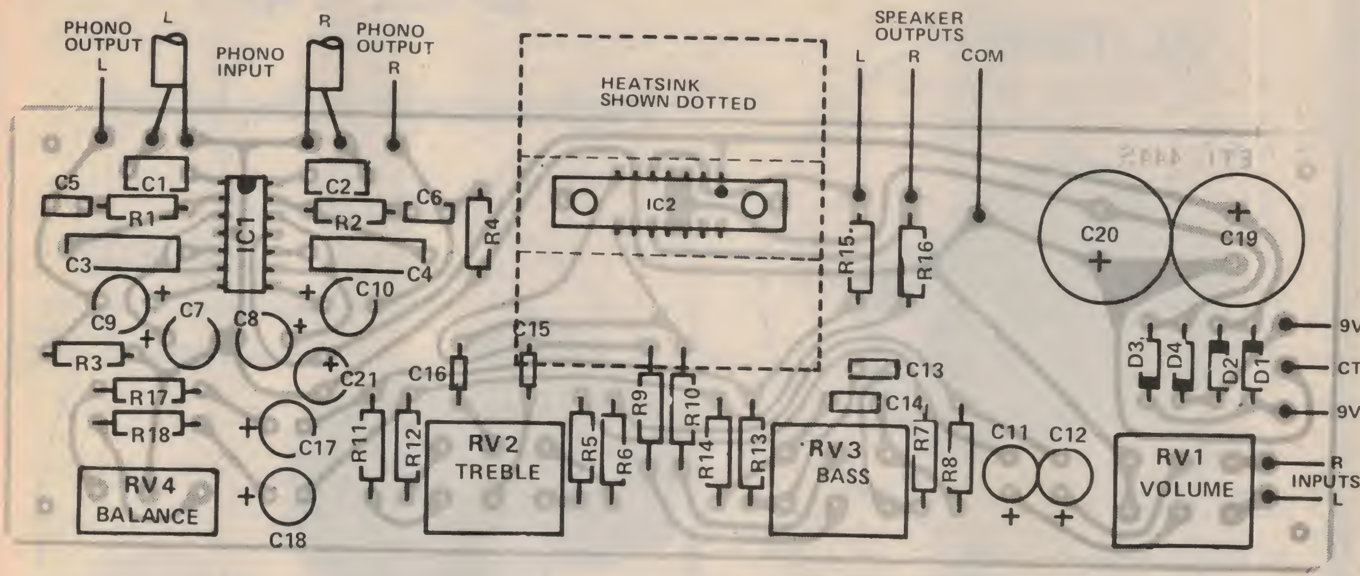


Fig. 4. The new PCB design. Full size 195 x 63 mm.

Fig. 5. Component overlay.



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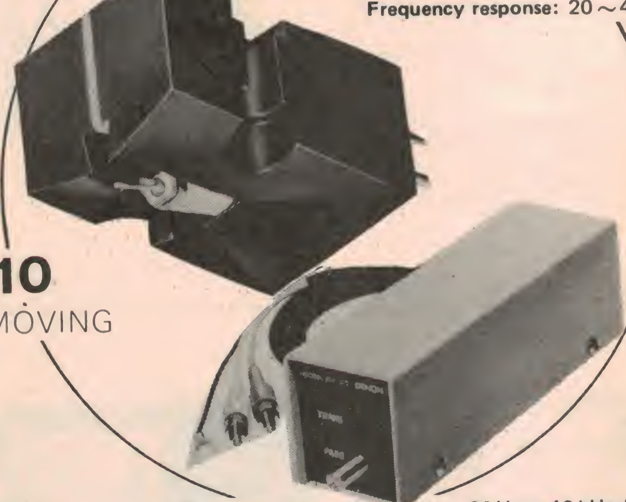

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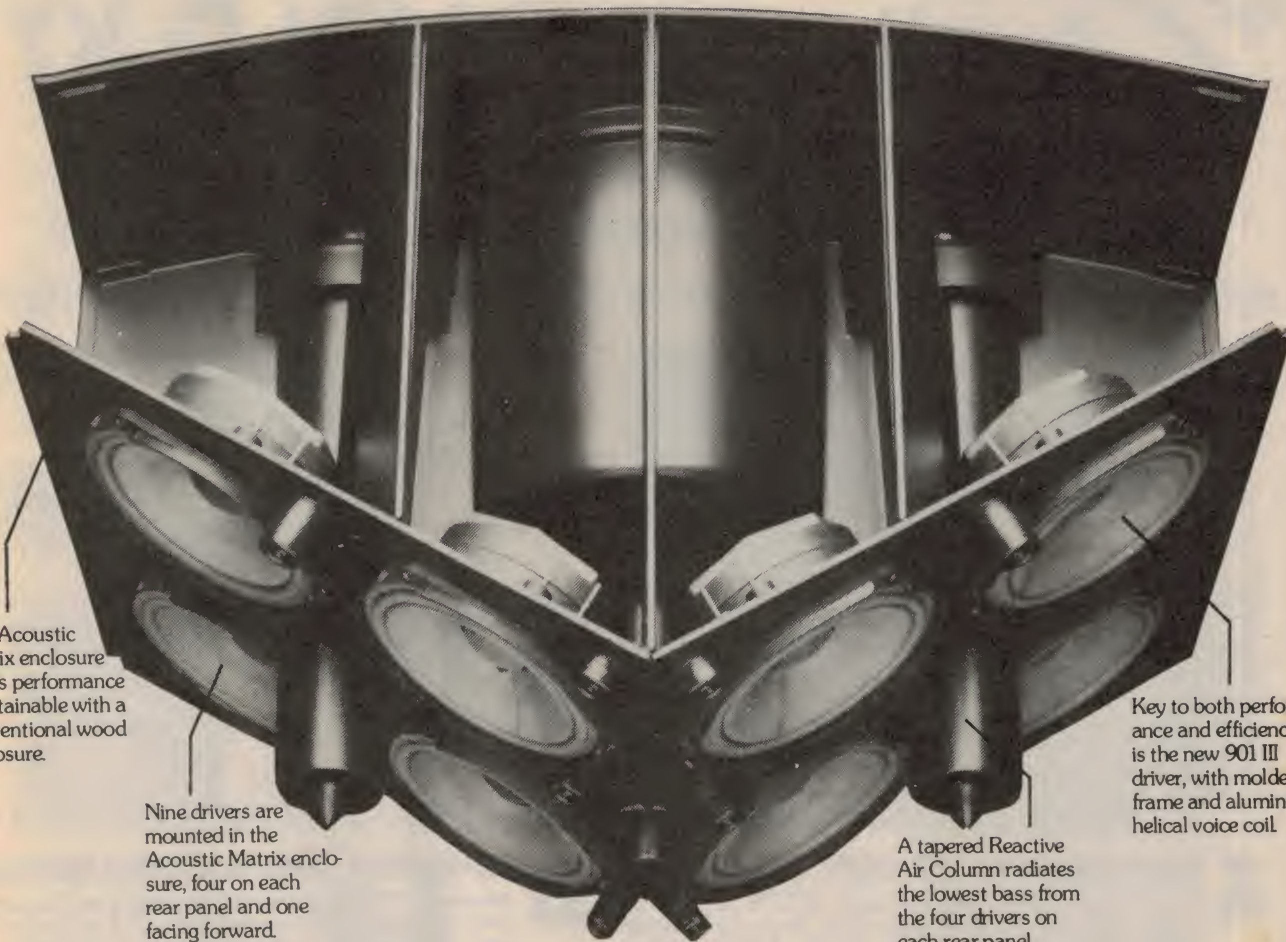

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Spectacular performance and efficiency are the results of proven Bose design concepts and technological innovations that include the unique, injection-molded Acoustic Matrix enclosure and a new, ultra-high efficiency driver.

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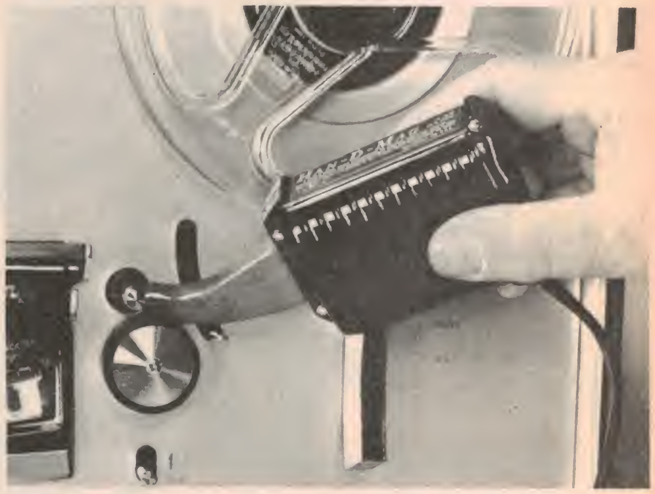

1 Check Magnetism in Recorder Components

The Annis Pocket Magnetometer quickly and accurately measures residual magnetism levels in recorder heads, drive capstans or tape guides. Indicates when it's time to demagnetize and lets you know when it's again safe to use the recorder.

2 Demagnetize Components When Necessary

Whenever the Magnetometer indicates any appreciable level of magnetism in a tape transport component, you can demagnetize it effectively with the powerful Annis Han-D-Mag before it causes permanent damage to recorded tapes.

• • • • • • •

Valuable audio and video tapes can be damaged when played on equipment that is not thoroughly and regularly demagnetized. Magnetism can easily build up in capstans, tape guides or recorder heads to a point where it will degrade the magnetically recorded signal on tapes passing over them. Tape damage is first apparent as a loss of recorded high frequencies and a progressive increase in background noise each time they are played on magnetized equipment.

Until recently, there has been no easy way to tell when demagnetizing was needed, and most Demagnetizers on the market were far too weak to be effective, particularly on offending hardened steel guides or capstans, etc. Now, with the introduction of the Audiophile Han-D-Kit, both measurement and correction problems can be solved easily at modest cost.

Here in one convenient package is everything needed to measure magnetic levels quickly, along with a handy, powerful unit to demagnetize components completely before they can spoil valuable tapes.

HERE'S WHAT THE AUDIOPHILE HAN-D-KIT CONTAINS

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Measures level of magnetism in components. Calibrated to read directly in gauss. Model 20/B5 shown.

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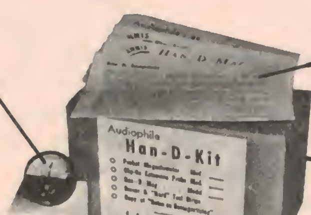

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RF CHOKES

Roger Harrison continues his Components Series with a close look the different styles of RF choke now available.

RADIO FREQUENCY chokes are used to prevent the passage of radio energy (hence the term 'choke') while allowing direct current or lower-frequency signals (eg, audio) to pass. This sort of application is principally one of decoupling; that is, isolating the RF — carrying portions of a circuit by providing a high RF impedance between two portions of the circuit. The principle also applies in RF interference suppression applications. For example, in reducing RF 'hash' from SCR or Triac motor speed controllers, light dimmers, etc.

RF chokes are also used widely in a variety of filter applications, eg, low-pass and high-pass filters. They are also used in pulse-forming networks and as frequency compensation components in wideband amplifiers (eg, video amplifiers).

RF chokes are also referred to as 'minichokes', 'microchokes' and 'video peaking chokes'.

Construction

The general range of construction styles employed are illustrated in Figure 1. The different winding styles have particular advantages and characteristics on which I will elaborate shortly. RF chokes are generally made in values according to the preferred series E6, E12, and E24, in tolerances of 5%, 10% and 20%.

Regardless of the form of the winding or the encapsulation, RF chokes are wound on bobbins consisting either of a phenolic or plastic material (non-magnetic), powdered iron or ferrite material. The last two materials, because of their high permeability increase the inductance of the winding effecting a decrease in the number of turns required as well as influencing the other characteristics of the choke — which I will discuss shortly.

The bobbin generally has integral pigtail leads moulded into the material to which the winding is terminated. Axial leads are the most common form although radial-lead RF chokes are obtainable — principally intended for printed-circuit mounting.

A form of construction that reduces the external magnetic field of the choke to negligible proportions is illustrated in Figure 2. This form of construction completely encloses the winding with the result that it has a very weak stray field, reducing 'crosstalk', or coupling, between the choke and adjacent components. In fact, two chokes can be mounted so that they touch each other over the full length of the bobbin — and crosstalk attenuation is quoted as 60 dB.

Low inductance RF chokes are usually 'solenoid' wound, whereby a single layer of wire is closewound on the bobbin. Chokes in the range 0.1 μH to 200 μH are generally solenoid-wound. The very low inductance types below 10 μH are generally wound on a non-magnetic bobbin. Powdered iron bobbins are generally used for chokes between about 5 μH and 100 μH, ferrite for the higher inductances to 200 μH or so.

Higher inductance chokes are obtained by overlapping several closewound layers on the bobbin. There is a limitation to this as the self-capacitance of the winding increases, decreasing the frequency range over which the choke is effective. This is discussed later. Chokes in the range 20 μH to 10 mH are often multilayer wound, generally on powdered iron or ferrite bobbins.

The Philips series of 'micro-chokes' cover the inductance range from 0.1 μH to 100 mH and employ solenoid or multilayer windings on the en-

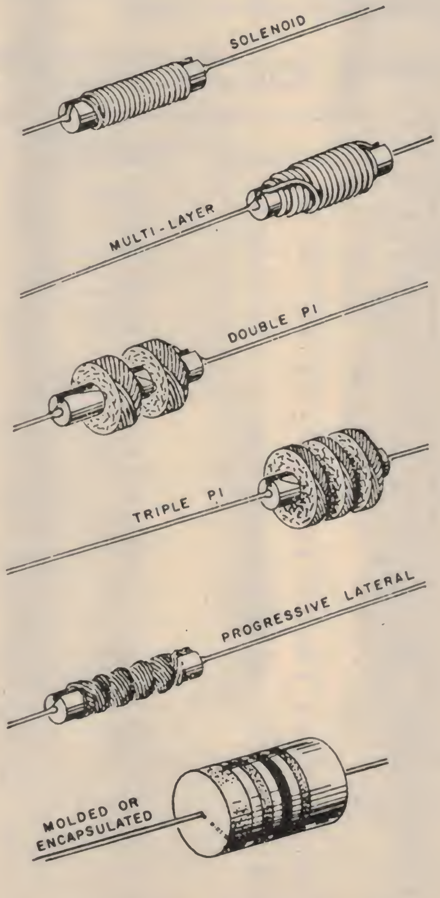


Fig. 1. General range of constructor styles of RF chokes. The particular style employed depends on the required or allowable component. Size, the inductance, the application and the required characteristics.

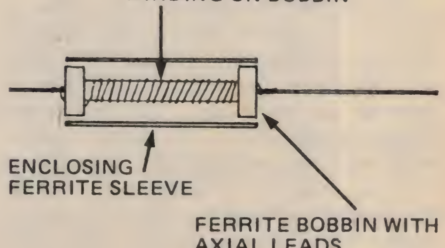


Fig. 2. Construction of fully-enclosed style of RF choke. Philips' 'microchokes' are made in this style.

RF CHOKES

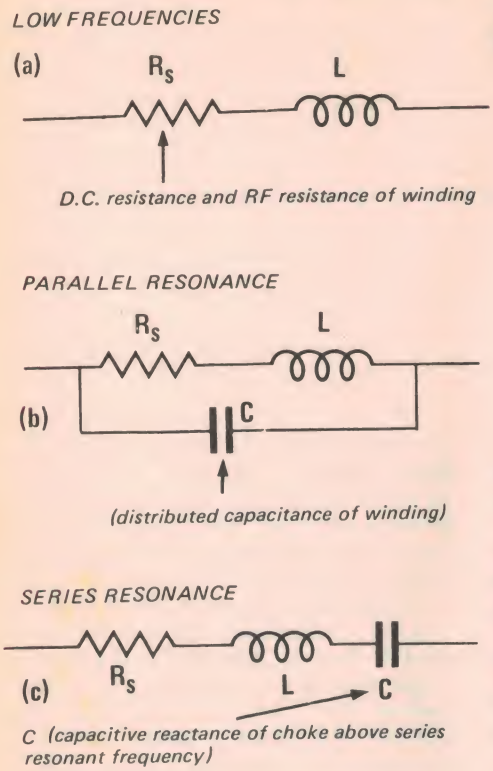


Fig. 3. Equivalent circuits of an RF choke over a wide frequency range.

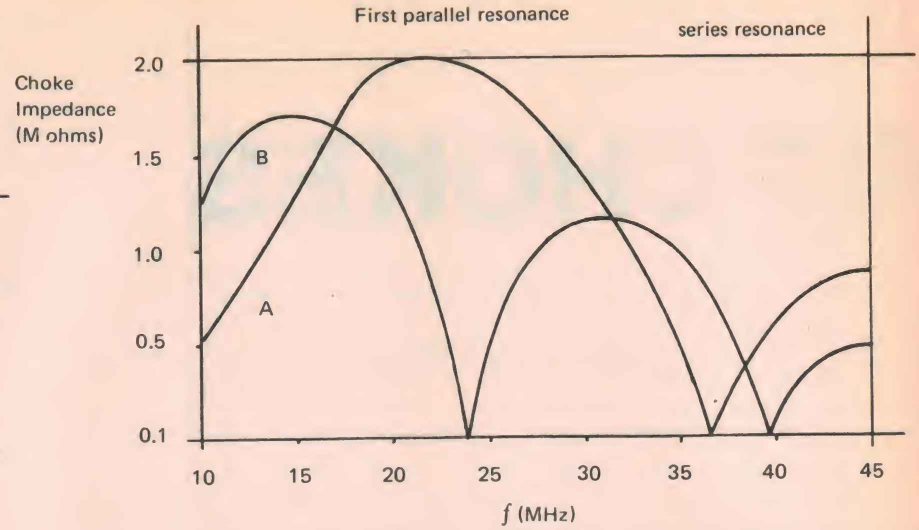


Fig. 4. Typical behavior of two RF chokes (A = around 10 µH, B = around 40 µH) over a range of frequencies.

closed ferrite bobbins as illustrated in Figure 2.

RF chokes from around 47 µH through to 100 mH are often 'pie-wound'. This is a form of winding where the wire is zig-zagged around the circumference of the bobbin and built up in many layers. The individual turns are not colinear — lying alongside the adjacent turns — but the wires cross at an angle due to the zig-zag winding, thus reducing the total self-capacitance of the coil. A multilayer winding wound in this way is termed a 'pie', the method of winding is also referred to as 'universal' winding.

Pie-wound RF chokes may have 1, 2, 3 or as many as 5 or 6, pies making up the inductance. Generally the pies are of the same width, diameter and number of turns but some types for special applications, or where special characteristics are required, are wound with a number of pies, each having a smaller diameter but a greater width than the preceding pie. This achieves a more uniform impedance characteristic over the desired frequency range.

A variation on the pie winding is the 'progressive lateral' type where the zig-zag winding is progressively moved along the bobbin rather than building a high, multilayer pie. This technique reduces the inherent self-capacitance of the winding and provides a more uniform impedance characteristic across the required frequency range.

Encapsulated chokes are generally of solenoid or multilayer construction, and are encapsulated in an epoxy or other suitable material. Pie-wound chokes are sometimes encapsulated although they are more usually wax-impregnated. Heat-shrink tubing is also used to enclose and protect RF chokes.

TABLE 1 Typical characteristics of encapsulated microchokes wound on ferrite bobbins as made by Philips.

L	Q @ F(MHz)		SELF-RESONANT FREQUENCY	DC RESISTANCE (Ω)	MAX. DC CURRENT	CONSTRUCTION & SIZE
0.1 µH	45	25	≈450 MHz	0.7	2.9 A	
0.15	45	25	≈400 MHz	0.12	2.8A	4 mm dia
0.22	45	25	≈350 MHz	0.14	2.7 A	by
0.33	45	25	≈300 MHz	0.17	2.6 A	10 mm long
0.47	45	25	≈270 MHz	0.21	1.7 A	* wound on
0.68	45	25	≈220 MHz	0.25	1.6 A	ferrite bobbin
1.0 µH	45	25	≈200 MHz	0.31	1.5 A	with ferrite
1.5	40	8	≈110 MHz	0.38	1.2 A	sleeve and
2.2	40	8	80	0.45	1.1 A	encapsulated.
3.3	40	8	60	0.53	900 mA	
4.7	40	8	55	0.63	650 mA	
6.8	40	8	45	1.0	500 mA	
10 µH	40	8	38	1.7	300 mA	
15	40	2	30	0.55	250 mA	
22	40	2	26	0.7	150 mA	
33	40	2	25	0.9	120 mA	
47	40	2	19	1.35	110 mA	
68	40	2	15	1.6	100 mA	
100µH	40	2	12	1.9	60 mA	
150	45	0.8	10	3.5	60 mA	
220	45	0.8	7.5	6.5	50 mA	
330	45	0.8	6.5	11	40 mA	
470	50	0.8	6.0	20	35 mA	
680	50	0.8	5.0	41	35 mA	
1 mH	50	0.8	4.0	48	25 mA	
1.5	50	0.25	3.1	25	100 mA	6.5 mm dia
2.2	50	0.25	2.9	30	100 mA	by
3.3	45	0.25	2.6	50	70 mA	10 mm long
4.7	45	0.25	2.4	60	60 mA	* same
6.8	40	0.25	2.3	75	50 mA	construction
10 mH	40	0.1	2.0	90	40 mA	as above.
15	40	0.1	1.4	110	20 mA	
22	40	0.1	1.3	130	15 mA	
33	35	0.1	1.3	130	15 mA	
33	35	0.1	1.3	275	12 mA	
47	35	0.1	1.2	400	10 mA	
68	30	0.1	1.1	470	9 mA	
100 mH	25	0.1	1	720	8 mA	
0.1						

L	Q @ F(MHz)		SELF-RESONANT FREQUENCY	DC RESISTANCE (Ω)	MAX. DC CURRENT	CONSTRUCTION & SIZE
0.1 µH	50	25	500 MHz	0.027	3.5 A	4 mm dia. by 9 mm long * solenoid wound on phenolic bobbin
0.15	50	25	510	0.03	3.0 A	
0.22	50	25	415	0.035	2.6A	
0.33	50	25	350	0.065	2.0 A	
0.47	50	25	300	0.085	1.7 A	
0.68	45	25	250	0.15	1.3 A	
1.0 µH	40	25	200	0.29	930 mA	
1.5	30	8	170	0.485	700 mA	
2.2	30	8	140	0.97	505 mA	
3.3	30	8	70	0.14	1.35 A	4 mm dia. by 9 mm long * wound on powdered iron bobbin
4.7	30	8	60	0.21	1.1 A	
6.8	25	8	50	0.375	810 mA	
10 µH	30	8	42	0.605	640 mA	
15	55	2.5	30	1.2	460 mA	
22	60	2.5	24	2.2	335 mA	4 mm dia by 9 mm long * wound on ferrite bobbin.
33	60	2.5	23	1.6	360 mA	
47	60	2.5	20	2.1	340 mA	
68	60	2.5	16	2.7	320 mA	
100 µH	55	2.5	10.5	3.3	275 mA	
150	60	0.8	7.2	4.1	230 mA	
220	65	0.8	6.2	5.0	200 mA	
330	70	0.8	5.4	7.0	170 mA	
470	70	0.8	4.7	9.55	145 mA	
680	65	0.8	3.6	13.8	115 mA	
1 mH	65	0.8	2.8	18.5	70 mA	6.5 mm dia by 12 mm long * wound on ferrite bobbin.
1.5	75	0.25	2.9	10	140 mA	
2.2	70	0.25	2.2	17.5	120 mA	
3.3	70	0.25	2.2	20.5	100 mA	
4.7	65	0.25	1.9	27.5	80 mA	
6.8	55	0.25	1.5	41.5	70 mA	
10 mH	50	0.25	1.5	51.5	50 mA	

TABLE 2 Typical characteristics of various encapsulated RF chokes, representative of those made by a variety of manufacturers.

Characteristics

RF chokes are an inductance that is required to have a high value of impedance over a wide range of frequencies.

In practice, an RF choke has inductance, distributed capacitance, and resistance. At low frequencies, the distributed capacitance has negligible effect and the electrical equivalent of the choke will be as shown in Figure 3(a). With increasing frequency the effect of the distributed capacitance becomes more evident until at some particular frequency it becomes a parallel resonant circuit. The equivalent circuit at and around this frequency is illustrated in Figure 3(b). At frequencies beyond this the overall reactance of the choke becomes capacitive and eventually the choke becomes a series resonant circuit, as shown in Figure 3(c).

The cycles of parallel resonance-reactance, series resonance, etc, repeat with increasing frequency, the overall impedance of the choke rapidly becoming lower past the initial cycles. This sort of characteristic is illustrated in Figure 4.

RF chokes should not be used within about ± 20 –30% of the series resonant frequency, nor more than about 1.5 times the series resonant frequency. Obviously, from Figure 4, they exhibit their greatest impedance around their parallel resonant frequency.

Tables, 1, 2 and 3 list data on typical RF chokes of several varieties and sizes – they should only be taken as a guide, consult the manufacturers' literature if the characteristics of a particular choke are required.

The lower the self capacitance of a particular style of winding, the higher will be the series resonant frequency (also referred to as the self-resonant frequency), thus allowing the choke to operate over a wide frequency range. Special windings, such as the progressive lateral, have extremely low distributed capacitance as well as less variation in impedance across the frequency range, compared to other styles. The variation in self resonant frequency versus choke inductance for three different bobbins and winding styles is illustrated in Figure 5.

The equivalent series resistance of a choke is made up of the actual dc resistance of the winding plus the RF resistance of the wire used due to 'skin effect'. The actual dc resistance of the

L	Q af (MHz)		SELF RESOANAT FREQUENCY	DC RESISTANCE (Ω)	MAX. DC CURRENT (mA0	NUMBER OF PIES	CONSTRUCTION DETAILS	
47 µH	55	2.5	12 MHz	3	250	1	6 mm	9 mm
100	50	2.5	9.8	5.1	190	1	7.5 mm	9 mm
120	60	0.8	9	5.7	180	1	8 mm	9 mm
150	60	0.8	8	6.3	170	1	8.5 mm	9 mm
220	60	0.8	6	7.8	160	1	9 mm	9 mm
270 µH	60	0.8	5.2	9	180	2	7.5 mm	9 mm
330	60	0.8	4.5	10	170	2	8 mm	9 mm
470	60	0.8	3.5	12.4	170	2	8.5 mm	9 mm
560	60	0.8	3	14	160	2	9 mm	9 mm
470 µH	60	0.8	6.5	14	160	3	7 mm	12 mm
560	60	0.8	5.5	15.5	160	3	7.5 mm	12 mm
680	60	0.8	4.5	17.2	150	3	8 mm	12 mm
820	60	0.8	4	19	140	3	8.5 mm	12 mm
1 mH	60	0.8	3.5	21	130	3	9 mm	12 mm
1.2 mH	60	0.25	3.1	23	130	3	9.5 mm	12 mm
820 µH	60	0.8	3.2	13	190	2	9 mm	13 mm
1 mH	60	0.8	3.2	16	170	2	9.5 mm	13 mm
1.2	60	0.25	3.1	19	160	2	10 mm	13 mm
1.5	65	0.25	3	22	150	2	10.5 mm	13 mm
2.2	65	0.25	2.5	28	130	2	11 mm	13 mm
2.5 mH	65	0.25	2	30	120	2	12 mm	13 mm
2.0 mH	60	0.25	1.8	26	150	2	11.5 mm	16 mm
2.2	60	0.25	1.7	28	140	2	12 mm	16 mm
2.5	60	0.25	1.5	30	140	2	12.5 mm	16 mm
2.7	60	0.25	1.45	32	130	2	13 mm	16 mm
3.0 mH	55	0.25	1.4	34	140	3	11 mm	16 mm
3.3 mH	55	0.25	1.3	36	130	3	11.5 mm	16 mm
4.7 mH	55	0.25	1.1	45	120	3	12 mm	16 mm
5.6 mH	55	0.25	1	50	110	3	12.5 mm	16 mm
6.8 mH	55	0.25	0.95	56	110	3	13 mm	16 mm
8.2 mH	55	0.25	0.9	63	100	3	13.5 mm	16 mm
10 mH	55	0.25	0.85	71	90	3	14 mm	16 mm

TABLE 3

Typical characteristics of a variety of pie-wound RF chokes, representative of a number of manufacturers.

RF CHOKES

choke may need to be taken into account in a circuit, particularly in high current circuits or with high inductance chokes. The latter may have dc resistances up to 500 or 600 ohms.

The equivalent series resistance (also called the 'apparent resistance') varies with frequency, reaching a peak before decreasing due to the shunting effect of the distributed capacitance of the winding. The variation of R_s with frequency for a range of inductances is illustrated in Figure 6.

Naturally enough, RF chokes have a limit to the amount of dc current they can carry without either overheating or effecting a change in the inductance outside the specified tolerance limits. Manufacturers specify a maximum dc current for their chokes, the figures given in tables 2 and 3 are only a guide. Seek out the manufacturer's data if in any doubt. Special high current chokes are manufactured for specific applications, eg, for RF hash suppression in SCR and Triac ac control circuits, filament chokes for high power RF transmitting tubes, etc.

RF chokes are generally low Q components. The actual Q specified by a manufacturer is generally the minimum Q, measured at a particular frequency, generally in the manner illustrated for several values and two sizes in Figure 7.

Markings

RF chokes are marked with their value and tolerance with the standard colour code or typographic code, in much the same way that resistors and some capacitors are marked.

There are several ways in which the colour code is marked on the body of

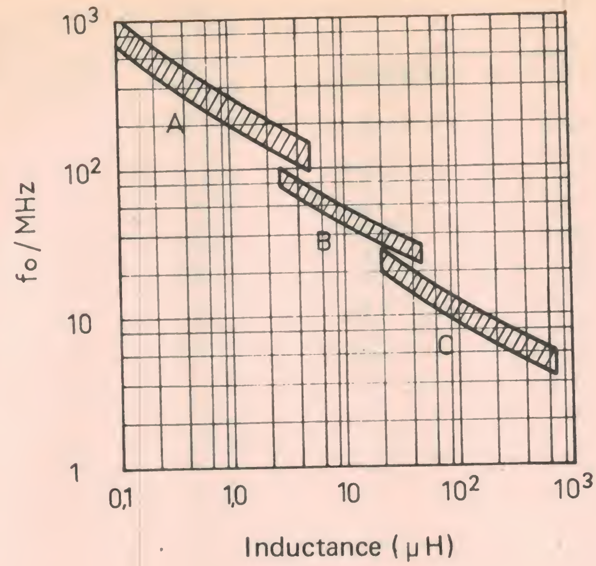


Fig. 5. Typical variation of self-resonant (or series-resonant) frequency against choke inductance for three different styles of choke construction.
A = non-magnetic bobbin
B = solenoid wound (single layer) chokes on powdered iron and ferrite bobbins
C = Multilayer chokes on powdered iron and ferrite bobbins.

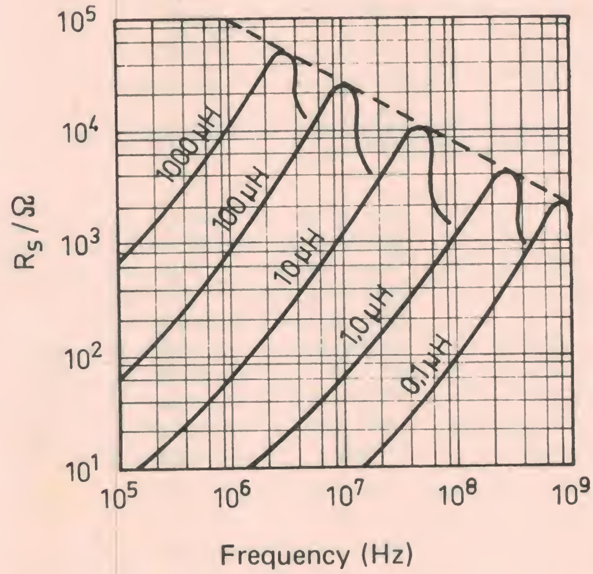


Fig. 6. Typical variation of equivalent serves resistance of a range of RF chokes against frequency.

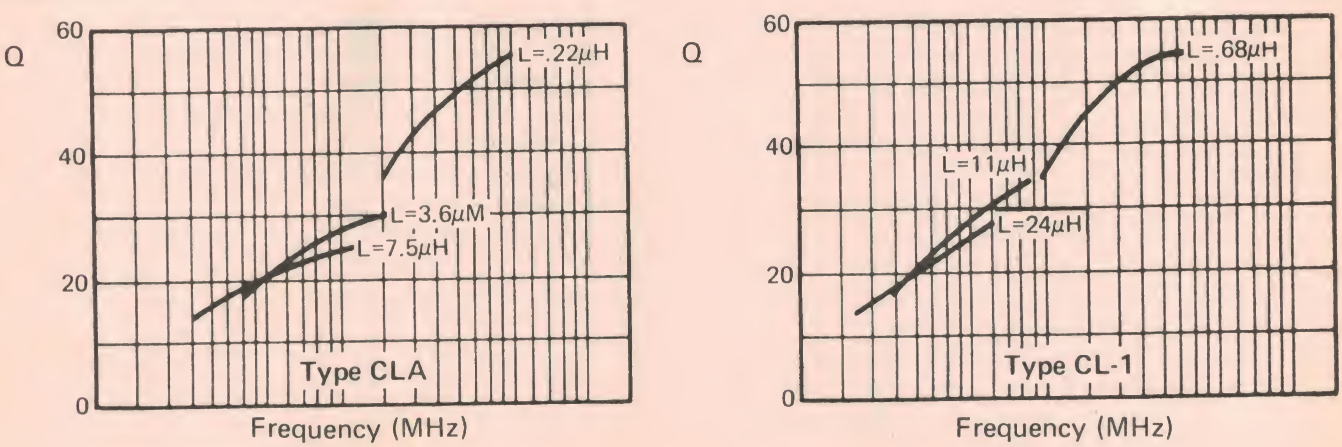
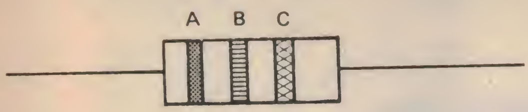


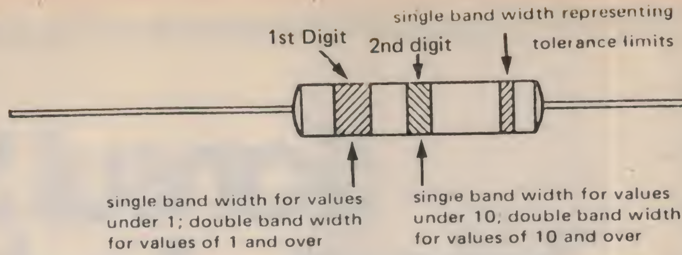
Fig. 7. Typical Q values versus frequency for several values of two different sizes of moulded RF chokes (From IRH).
CLA = 6.4 mm dia. x 78 mm long.
CL1 = 6.4 mm dia. x 27 mm long.



A = First digit
B = Second digit
C = Multiplier

COLOUR	A & B	C
SILVER		10^{-2}
GOLD		10^{-1}
BLACK	0	1
BROWN	1	10^{1}
RED	2	10^{2}
ORANGE	3	10^{3}
YELLOW	4	10^{4}
GREEN	5	10^{5}
BLUE	6	10^{6}
VIOLET	7	10^{7}
GREY	8	10^{8}
WHITE	9	10^{9}

Fig. 8. This colour code for RF chokes follows that for resistors most closely. Principally used by Philips on their 'microchoke' range.

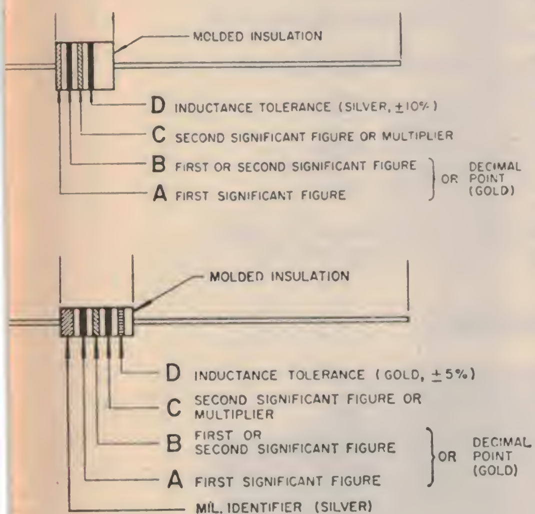


Example: 0 — 0.91 two single bands
1.0 — 9.1 double-single
10.0 — 24.0 double double

Fig. 9. This code varies the widths of the first two bands to indicate the position of the decimal point in the value. The code is read from left to right, as is conventional.

COLOUR CODE

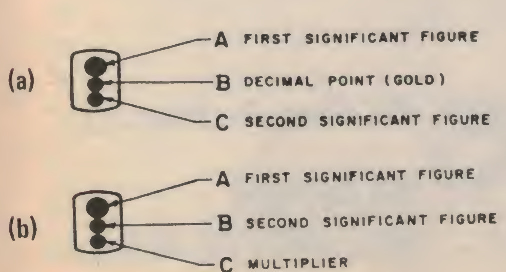
COLOUR	SIGNIFICANT FIGURE	MULTIPLIER
Black	0	1
Brown	1	10
Red	2	100
Orange	3	1000
Yellow	4	10 000
Green	5	100 000
Blue	6	1000 000
Violet	7	
Grey	8	
White	9	



EXAMPLES

A = GOLD B = ORANGE C = ORANGE D = SILVER	0.33 μH, ±10% A = YELLOW B = GOLD C = VIOLET D = GOLD	4.7 μH, ±5% A = BROWN B = RED C = ORANGE D = GOLD 15 mH, ±5%

Fig. 10. This is similar to the code in figure 8 but the decimal point for values under 10μH is indicated by a gold band for bands A or B. A mil-Spec component is identified by broad silver band preceeding the value and tolerance bands. Some manufacturers use a dot to indicate the tolerance value as illustrated here.



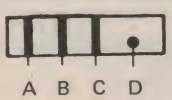


Fig. 11. Miniature radial lead RF chokes for printed circuit mounting may be colour-coded as shown here. The decimal point is indicated by a gold dot at either A or B, the value being read off in the same way as illustrated in figure 10. Note that the value is read commencing at the largest dot.

the choke and these are illustrated in Figures 8, 9, 10, and 11.

The nominal inductance value is always indicated in microhenries (μH).

Where a typographic code is employed it is generally of a quite simple form, similar to that used on resistors. The nominal inductance value, again, is always expressed in microhenries (μH). The value is identified as follows:—

Nominal inductance values less than 100 μH are identified with three (3) numbers representing the significant figures, the letter R being used to designate the decimal point.

eg,
0.68 μ H = R680
4.7 μH = 4R70
33 μH = 33R0

Nominal inductance values of 100 μH and above are identified by a four digit number. The first three (3) digits represent the significant figures of the value and the last digit specifies the number of the following zeroes,

eg,
680 μH = 6800
4700 μH 4701 (4.7 mH)
33000 μH 3302 (33 mH)

In addition, a single letter may be added to indicate the tolerance, as follows:

J = ± 5%
K = ± 10%
M = ± 20%

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Total Harmonic Distortion: Overall (from AUX) less than 0.05% at or below rated min. RMS power output.

Intermodulation Distortion: (70Hz:7,000Hz = 4:1 SMPTE method). Overall (from AUX) less than 0.05%.

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Power Amplifier Only 10 to 70,000Hz + 0dB, −1.0dB

Damping Factor: approximately 80 to 8 ohm load

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Phono 1–better than 55dB (at 3mV sensitivity)
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Aux–better than 60dB
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7407	.89	.80
7408	.39	.35
7409	.39	.35
7410	.39	.35
7411	.45	.39
7413	.89	.80
7414	2.25	1.95
7416	.89	.80
7417	.89	.80
7420	.39	.35
7426	.59	.55
7430	.39	.35
7432	.55	.50
7437	.75	.69
7438	.75	.69
7440	.39	.35
7441	1.50	1.35
7442	1.30	
7447	1.80	1.15
7448	1.80	1.60
7450	.39	.35
7451	.39	.35
7453	.39	.35
7454	.39	.35
7460	.39	.35
7470	.70	.63
7472	.60	.50
7473	.75	.69
7474	.75	.69
7475	1.10	.95
7476	.80	.72
7480	1.20	1.05
7482	1.20	1.05
7483	1.40	1.25
7485	2.50	2.25
7486	.70	.62
7489	3.50	2.95
7490	.80	.72
7491	1.40	1.25
7492	.95	.85
7493	.95	.85
7494	1.80	1.60
7495	1.80	1.60
74100	2.90	2.60
74107	.69	.62
74121	.75	.69
74123	1.05	.95
74150	2.60	2.35
74151	1.70	1.50
74153	1.55	1.40
74154	2.50	2.25
74157	1.70	1.50
74160	2.20	2.00
74164	2.30	2.10
74165	2.30	2.10
74173	2.75	2.50
74175	2.50	2.20
74192	2.20	1.95
74193	2.20	1.95
74221	1.55	1.35

LOW POWER SCHOTTKY

74LS00	.45	.39
74LS01	.45	.39
74LS02	.45	.39
74LS03	.45	.39
74LS04	.45	.39
74LS05	.45	.39
74LS08	.45	.39
74LS09	.45	.39
74LS10	.45	.39
74LS11	.45	.39
74LS12	.45	.39
74LS14	2.35	2.15
74LS20	.45	.39
74LS21	.45	.39
74LS27	.51	.45
74LS28	.51	.45
74LS30	.45	.39
74LS32	.51	.45
74LS37	.51	.45
74LS38	.51	.45
74LS40	.51	.45
74LS42	1.85	1.60
74LS73	.60	.55
74LS74	.65	.60
74LS75	1.00	.90
74LS78	.65	.55
74LS85	2.65	2.35
74LS86	.70	.65
74LS90	1.65	1.45
74LS92	1.65	1.45
74LS93	1.65	1.45
74LS109	.75	.69
74LS113	.70	.60
74LS114	.70	.60
74LS138	2.20	1.95
74LS151	2.00	1.80
74LS154	2.65	2.35
74LS157	2.20	1.95
74LS163	2.70	2.40
74LS164	2.30	2.10
74LS174	2.30	2.10
74LS175	2.30	2.10
74LS181	2.30	2.10
74LS192	2.95	2.65
74LS193	2.95	2.65
74LS194	2.40	2.20
74LS195	2.40	2.20
74LS196	2.40	2.20
74LS221	2.20	1.95
74LS253	2.20	1.95
74LS367	2.00	1.75
74LS368	2.00	1.75

CMOS	1–9	10UP
74C00	.45	.39
74C02	.45	.39
74C04	.45	.39
74C08	.45	.39
74C10	.45	.39
74C14	2.15	1.75
74C48	3.30	2.95
74C73	1.10	.95
74C76	1.10	.95
74C89	12.75	11.50
74C90	2.35	2.15
74C93	2.35	2.15
74C175	2.60	2.35
74C192	3.10	2.90
74C193	3.10	2.90
74C221	2.35	2.15
4000	.39	.35
4001	.35	.29
4002	.39	.35
4006	2.35	2.15
4007	.39	.35
4008	2.10	1.90
4009	1.20	1.10
4010	1.20	1.10
4011	.35	.29
4012	.45	.39
4013	1.00	.90
4014	2.50	2.30
4015	2.20	1.95
4016	1.00	.90
4017	2.20	2.00
4018	2.50	2.30
4019	1.35	1.15
4020	2.60	2.40
4021	2.60	2.40
4022	2.40	2.20
4023	.45	.39
4024	1.90	1.70
4025	.45	.39
4027	1.20	1.10
4028	2.00	1.80
4029	2.40	2.20
4030	1.10	1.00
4035	2.50	2.25
4040	2.65	2.35
4042		
4043	1.65	1.50
4044	1.65	1.50
4046	2.75	2.45
4049	1.00	.90
4050	1.00	.90
4051	2.60	2.35
4052	2.60	2.35
4053	2.60	2.35
4060	2.85	2.60
4066	1.20	1.10
4068	.45	.39
4069	.45	.39
4070	.45	.39
4071	.45	.39
4072	.45	.39
4073	.45	.39
4075	.45	.39
4076	2.80	2.60
4077	.50	.42
4078	.45	.39
4081	.45	.39
4082	.45	.39
4093	1.40	1.20
4416	1.30	1.20
4426	3.75	3.35
4449	.45	.39
4511	2.50	2.30
4518	2.65	2.40
4520	2.65	2.40
14553	7.95	7.25

LINEAR	1–9	10UP
LM301	.75	.65
LM307	1.20	1.00
LM308	2.00	1.80
LM309K	2.00	1.95
LM317K	3.85	3.50
LM323	8.75	7.75
LM324	3.00	2.70
LM325	3.75	3.20
LM339	3.20	2.95
LM320T–12	2.95	2.60
LM340T–5	2.20	1.95
LM340T–6	2.20	1.95
LM340T–8	2.20	1.95
LM340T–12	2.20	1.95
LM340T–15	2.20	1.95
LM340T–18	2.20	1.95
LM340T–24	2.20	1.95
LM349	2.25	2.00
LM379	7.50	6.75
LM380N	2.40	2.00
LM381	2.40	2.00
LM382	2.40	2.00
LM384	2.70	2.40
LM386	1.95	1.75
NE536T	4.20	3.60
NE540	4.20	3.60
NE555	.70	.60
NE556	1.80	1.40
LM565	2.35	2.15
LM566	2.50	2.25
LM567	3.95	3.50
NE571	11.95	10.75
LM709	.75	.65
LM741CN	.65	.60
LM747N	1.65	1.50
LM1310N	3.00	2.50
CA3089	3.50	3.15
CA3130	1.95	1.75
LM3900	1.50	1.30
LM3909	1.50	1.30
ZN414	4.75	3.95
TCA220	2.25	2.00
8038B	8.50	7.95
SAK140	2.50	2.15
UAA170	3.55	3.20
UAA180	3.00	2.70
MK50242	14.50	12.50

OPTO	1–9	10UP
5025 Red Led with clip	.35	.30
LD57 Green Led with clip	.45	.35
LD241 Infrared Led	2.50	2.25
LD461 Miniature Red PC Mounting	.35	.30
MEL12 Photo Darlington Transistor	1.50	1.35
NSN71 0.3" common anode display	2.40	2.00
NSN74 0.3" common cathode display	2.40	2.00
NSN61 0.6" common anode display	3.20	2.75
NSN64 0.6" common cathode display	3.20	2.75
FND500 0.5" common anode display	2.50	2.20

DIODES		
OA91 general purpose germaium	.20	.15
IN914/IN4148 silicon signal diode	.10	.07
IN4004 400V 1A diode	.11	.08
IN4007 1000V 1A diode	.20	.15
A15A 100V 5A diode	.75	.65
MD3501 100V 35A bridge	3.95	3.60
MD3504 400V 35A bridge	4.70	4.20
BZX79 series Zener diodes (select voltage) 3.3, 4.7, 5.1, 5.6, 6.2, 8.2, 10, 12, 15, 18, 20	.30	.20

TRANSISTORS	1–9	10UP
BC547, 548, 549	.25	.20
BC557, 558, 559	.25	.20
BC639, 640	.80	.70
BD137, 138	.85	.75
BD139, 140	1.00	.85
BF180	1.20	.95
MJ2955	1.95	1.75
BD266, 267	2.50	2.20
2N3055	1.10	1.00
2N6577	2.50	2.30
2N3442	3.60	3.20
40411	4.00	3.50
2N3638	.50	.40
PN3643	.55	.45
2N3644	.55	.45
2N4220	1.20	1.00
MPF102	.70	.60
2N5459	.75	.70
2N5461	.85	.75
2N5485	.90	.80
2N6027	1.30	1.10
2N2646	1.85	1.65
MPSA12	.80	.70
MPSA14	.90	.80
BC327	.45	.35
MPF131	1.20	1.10
MJE340	1.75	1.50

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PRINT-OUT

ETI's COMPUTER SECTION

This month Kevin Barnes looks at a Space War Game.

NEWS

NOT SO MICRO

Although most micros can access up to 64K of memory directly, there are various tricks that can be used to expand this — for example, software relocatable memory, paging, etc. Now Imsai, following the multiprocessor techniques used in their floppy disc controller, have produced a memory controller which allows their 8080 CPU card to access up to one megabyte of RAM. Now, with standard 4K RAM boards, that's 256 slots, but potential problems have been solved by the introduction of a 32K and a 64K RAM card. Whatever happened to the MICROprocessor?

NEW PROCESSOR

Fairlight Camera and Instrument is to offer a one-chip version of its F8 microprocessor. The 3859 will carry 1K of memory and will be functionally compatible with the older 3850/3851 combination. A 2K version, the 3860, is also in the pipeline.

AUCKLAND COMPUTER CLUB

The first meeting of the Auckland Computer Club was held in April and the club is now seeking new members. For more details write to PO Box 27206, Auckland, NZ.

BRISBANE COMPUTER CLUB

Norman Wilson, VK4NP, has offered to organise computer amateurs in the Brisbane area so that a club can be inaugurated. If you are interested please write to Norman at PO Box 81, Albion, Queensland, 4010. It might be an idea to send a stamped addressed envelope so you can be advised of the first meeting. Or you can phone Norman during working hours on 262-1351.

SYDNEY COMPUTER CLUB

The Microcomputer Enthusiasts Group continues to meet on the first and third Mondays of each month at 14 Atchison St., Crows Nest. The club has recently received gifts of a Motorola D1 Evaluation Kit from Total Electronics and a Signetics KT9500 microprocessor card from Philips.

NATIONAL & SIGNETICS SWAP

National and Signetics have signed an agreement to enable them to manufacture and supply each other's 8-bit microprocessors. So the SC/MP will be available from Philips and the 2650 from National, if all goes as planned.

ETI VDU

The ETI VDU is proving very popular with amateurs and professionals alike — thanks to its versatility and economical design. Now Applied Technology are selling an even cheaper version than the original modular project: the whole unit has been laid out on just two boards, saving the cost of connectors and mother board, for customers who want a straightforward easy-to-build VDU without modifications. Applied Technology have also added a VHF modulator so any TV set can be used.

S100 STANDARD

We are pleased to see that Australian computer enthusiasts can now buy hardware to help a hobbyists standard, along the lines of the US S100 standard, be established. The S100 is far from a universal standard but we think it is a good start, and the best proposal so far. In a future Print-Out we hope to discuss the standard and say how much we feel should be rigidly followed by local manufacturers, computer clubs and magazine projects, and how we would like some built-in flexibility so the standard can be applied to as many applications as possible.

An S100 CPU/Front-Panel using the 8080 and octal notation is available from Computer Bits of Bankstown, NSW. We have one of these kits in for review and will be publishing details soon. Owen Hill of Applied Technology is jumping on the bus, too, with a 4K S100 RAM.

SPACE WAR

Kevin Barnes describes the Scelbi Galaxy Game

NOW THAT MORE and more people have personal computers it's not surprising that there are large numbers of Space War programs around. Space War, the most popular of all the computer games being played today, is a strategy game in which the computer simulates a region of space containing stars, spaceships and you. Unfortunately the most Space War programs are written in Basic and so require the host computer to have quite large amounts of memory available (like 20K bytes) as well as Basic Interpreter program. You will realise then the interest created by a book that contains a Space War needing only 4K bytes of memory.

The book, titled 'Galaxy Game', comes in two versions, one with the program written in 6800 machine code the other written in 8080 machine code. The reason this version requires only 4K of memory is that it is written in machine code. Because machine code programs are much more efficient in terms of memory Scelbi have managed to pack a program of similar performance to the Basic version in only one fifth the memory. Other significant points about the book are that it contains a full source listing of the Space War program and a set of flow charts. This means it would be quite easy to modify it for both other 8600 or 8080 systems, or it would easily be expanded into a more sophisticated game.

The program was very quickly typed up and loaded into a spare 6800 system and we were soon hurtling through space in search of adventure. After playing a few games we realised that some of our readers would also be interested in going on a space voyage with us, so presented here is a brief historical background on the game and the computer print out of one of our less successful voyages.

Space War has become the generic term used to describe a whole range of games. Although the author has seen reference to Space War games being played on computer back in the late 1950s it was in the mid-sixties that another dimension was added to the game. This was caused by the release of a TV series called STAR TREK. In this series the TV audience were invited to follow the exploits and adventures of the Captain and crew of the star ship Enterprise as it went on its 5 year exploration mission.

Although the Star Trek series went out of production seven years ago its influence is still present today. A regular feature in America is the 'Star Trek Convention' where thousands of fans meet to talk about the series and generally have a good time. Star Trek also had an influence on the computer world, Space War games suddenly became Star Trek games.

No longer did the player pilot a lowly spaceship through the voids of space, instead he captained the Starship Enterprise just like the famous Captain Kirk does on TV. As well the bad guys in the game took form and names; they were called Klingons, a war-like arrogant species dedicated to the destruction of Federation of Planets (a peaceful organization set up by the people of Earth).

In general the TV series had the effect of providing a universal theme around which the programmer could build his version of Space War. Because of the TV programme other players were also aware of that theme and so had no difficulty in understanding how to play the game. This is most obvious when you look at a cross section of the games presently being played and observe the

'GALAXY' SPACE WAR

Kevin Barnes shows how to deal with Klingons but doesn't look where he's going.

Underlined characters are operator entered.

```
*G  SCELBI'S GALAXY GAME
DO YOU WANT TO GO ON A SPACE VOYAGE? Y
YOU MUST DESTROY 10 ALIEN SHIPS IN 15 STARDATES WITH 6 SPACE STATIONS
 -1--2--3--4--5--6--7--8-
1                          STARDATE  3035
2                          CONDITION GREEN
3      <*>                 QUADRANT  1,3
4          *               SECTOR    3,3
5                          ENERGY    5000
6                          TORPEDOES 10
7                          SHIELDS   0000
8
 -1--2--3--4--5--6--7--8-
```

A short-range scan of quadrant 1,3. Only me and one star in this quadrant.

```
COMMAND?2
L.R. SCAN FOR QUADRANT  1,3
-------------------
1 000 1 000 1 000 1
-------------------
1 015 1 001 1 000 1
-------------------
1 000 1 005 1 004 1
-------------------
```

Let's have a look in the quadrants that surround me. No aliens in sight but there is a space station on my left.

```
COMMAND?3
GALAXY DISPLAY
-------------------------------------------------
1 000 1 015 1 001 1 000 1 004 1 003 1 002 1 013 1
-------------------------------------------------
1 105 1 000 1 005 1 004 1 000 1 005 1 000 1 000 1
-------------------------------------------------
1 007 1 000 1 002 1 000 1 000 1 001 1 003 1 000 1
-------------------------------------------------
1 000 1 003 1 103 1 000 1 003 1 115 1 002 1 000 1
-------------------------------------------------
1 007 1 000 1 002 1 105 1 013 1 004 1 003 1 000 1
-------------------------------------------------
1 000 1 000 1 000 1 004 1 003 1 000 1 103 1 002 1
-------------------------------------------------
1 106 1 013 1 104 1 000 1 117 1 000 1 000 1 003 1
-------------------------------------------------
1 000 1 000 1 000 1 106 1 000 1 103 1 004 1 007 1
-------------------------------------------------
```

I feel lonely. Let's have a look at the whole galaxy. There's an alien in quadrant 4,3. I will go for him first.

similarity between them. For example the weapons used to fight the enemy are almost always Phasers and Photon Torpedos and the space ship engines are Warp engines.

In the Galaxy game the player, that's you, is charged with the responsibility of destroying all the alien ships in the galaxy. You are given a certain amount of time to accomplish your mission. If you fail, you will allow the remaining alien ships to conquer the Earth, however, if you succeed you will be the hero of Earth. Your fate and that of all earth depends on your logic, ingenuity and (when Mr Spock's not listening) your intuition.

The exact number of alien ships which have to be destroyed is stated in the sign-on message along with the length of time you have to complete the mission (in stardates) and the number of space stations available for refuelling and re-arming. The galaxy is set up randomly at the start of each game so that no two games will be identical.

The galaxy is made up of 64 'quadrants' arranged in an eight by eight matrix. Each quadrant is identified by a two-digit number. The first digit is the row count and the second digit the column count. Each quadrant is made up of 64 sectors also arranged in an eight by eight matrix.

To instruct the computer the operator has seven commands and each command is assigned a number, by entering that number the operator tells the computer what command to execute.

Space Ship Movement Command 0
Short Range Scan Command 1
Long Range Scan Command 2
Galaxy Display 3
Shield Command. 4
Phasor Command 5
Torpedo Command 6

To indicate the direction in which you want the space ship to travel or the torpedo to be fired you use a special compass. Each direction has a number assigned to it, inputting that number to the computer tells it which arrow to follow.

The first map displayed in the sample print-out is a short range scan of one quadrant, in this case quadrant 1, 3. The number count around the borders shows that there are 64 or eight by eight sectors in a quadrant.

<*> symbol is you.
* is a star.
+++ symbol is an alien craft.
>*< symbol is a space station where you can replenish your supplies.

Down the right hand side of the short range scan map is the status board. This is the control board by which you pilot your space ship. Condition green means there are no aliens in sight so you can relax. The Energy count is an indicator of the amount of fuel left to power your ship and weapons. Keep an eye on this, if it ever falls to zero then you are dead.

The shields are the protective barriers or force fields used to protect the ship in case of collision or attack. The more energy you transfer to them with the Shield command the more protection you have.

The Long Range Scan is like radar, and lets you find out what's in each of the quadrants that border the quadrant you are in. The three digit number is the readout for that quadrant. The first digit in the readout is the number of aliens in the quadrant, the middle digit the number of space stations and the right hand digit the number of stars.

The Galaxy Display, command 3, is really a map of the whole galaxy with the contents of each quadrant shown in same format as the Long Range Scan. This display lets you plan a long range course to successfully complete a mission. Note that the Long Range Scan of the sample agrees with the Galaxy Display.

The Phasor Control, command 5, directs the phasors' energy at the alien ship in the quadrant you are in. You have to select the amount of energy you want to fire. A tricky decision, because if the alien is not detroyed with the first shot he then starts shooting back at you!

Torpedo Control, command 6, fires a torpedo in the direction specified. Each torpedo requires 250 units of energy to fire and if you aim it correctly and hits the alien you are guaranteed a kill. If you miss, however, he will fire his phasors at you in retaliation, so aim carefully.

The Scelbi Galaxy game for the 8080 or 6800 is available in Australia for $15.95 plus $1 p&p from the Peoples Software Factory, PO Box 1, Ermington , NSW.

```
COMMAND?0
COURSE (1-8.5)? 7.0
WARF FACTOR (0.1-7.7)? 3.0
 -1--2--3--4--5--6--7--8-
1
2       +++               *  STARDATE   3036
3       <*>                  CONDITION RED
4  *                         QUADRANT   4,3
5                            SECTOR     3,3
6                            ENERGY     4835
7                *           TORPEDOES 10
8                            SHIELDS    0000
 -1--2--3--4--5--6--7--8-
```

A short range scan for quadrant 4,3. As he's right next to me I'm well set up for this shot. I'll use a torpedo.

```
COMMAND?6
TORPEDO TRAJECTORY(1-8.5) : 7.0
TRACKING: 4,3
TRACKING: 5,3
TRACKING: 6,3
TRACKING: 7,3
TRACKING: 8,3
YOU MISSED! ALIEN SHIP RETALIATES
LOSS OF ENERGY 0200
DANGER-SHIELD ENERGY 000
```

Missed! Oh dear, I forgot to put my shields up. Guess I'd better do it now.

```
COMMAND?4
SHIELD ENERGY TRANSFER = 1000
COMMAND?5
PHASOR ENERGY TO FIRE = 0100
ALIEN SHIP AT SECTOR 2,3: ENERGY = 0337
LOSS OF ENERGY 0099
```

I'll try a phasor shot — they never miss.
Not enough energy.

```
COMMAND?5
PHASOR ENERGY TO FIRE = 0400
ALIEN SHIP AT SECTOR 2,3: DESTROYED
```

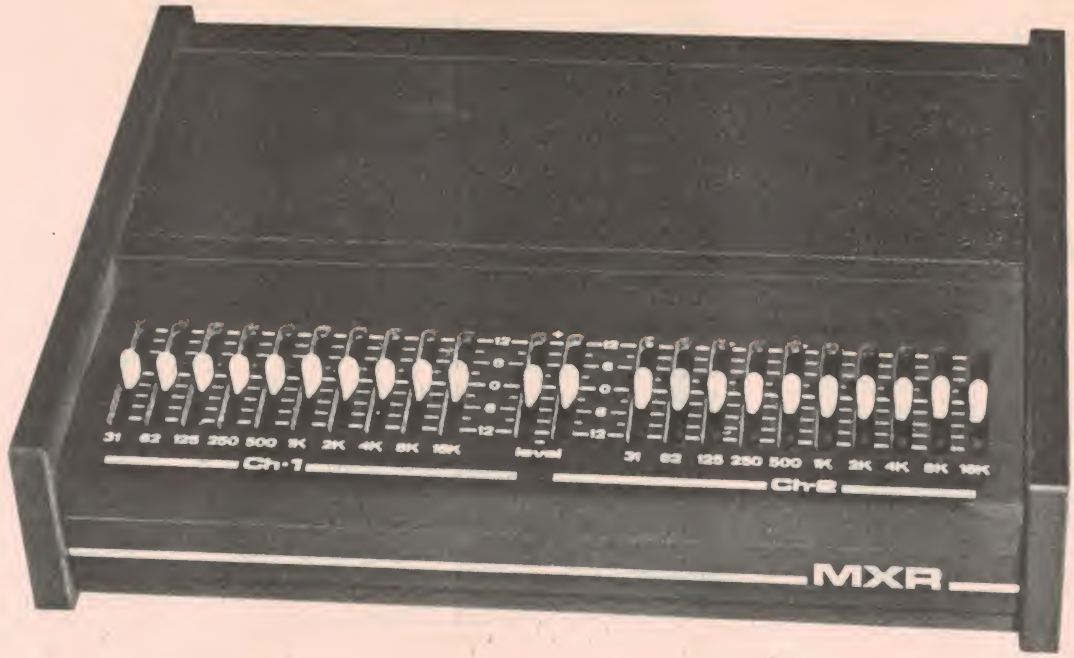
Ha-ha, got him that time.

```
COMMAND?2
L.R. SCAN FOR QUADRANT  4,3
-------------------
1 000 1 002 1 000 1
-------------------
1 003 1 003 1 000 1
-------------------
1 000 1 002 1 105 1
-------------------
```

That was easy, let's find another alien.

```
COMMAND?0
COURSE (1-8.5)? 7.5
WARP FACTOR (0.1-7.7)? 1.0
KA-BOOM, YOU CRASHED INTO A STAR. YOUR SHIP IS DESTROYED
DO YOU WANT TO GO ON A SPACE VOYAGE? N
CHICKEN!
```

Oh well, you can't win them all.


31 62 125 250 500 1K 2K 4K 8K 16K
Ch-1
level
31 62 125 250 500 1K 2K 4K 8K 16K
Ch-2
MXR

Well stacked in front

The new range of JVC front-loading cassettes is here. And if you think that's the only change, you're highly mistaken. Because, as usual, JVC brings in the range with a few unique additions which are going to make you think twice about any other brand.

For a start, the JVC ANRS sound reduction system is incorporated throughout, to make hi fi recording and playback as free of hiss as possible. And in some cases, even improving the dynamic range of normal cassettes.

Another exclusive is the JVC Sen-alloy head, and believe it or not, it offers you the clearest sound and longest wearing lifespan of any head available; originally designed solely for professional use, this head is now incorporated in JVC cassette decks CD-S200 and CD-1970.

And yet another first: JVC is the only manufacturer to provide decks with 5 LED peak-level indicators so that your recordings are perfect at all times. These are featured on models CD-1920 and CD-S200.

Loading is, of course, simplified. The special compartment is air-damped and removable for uncramped head maintenance.

The JVC famous range of top-loaders is still available, offering you the very highest quality. All things considered, there is no other consideration.

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______________ P/Code __________

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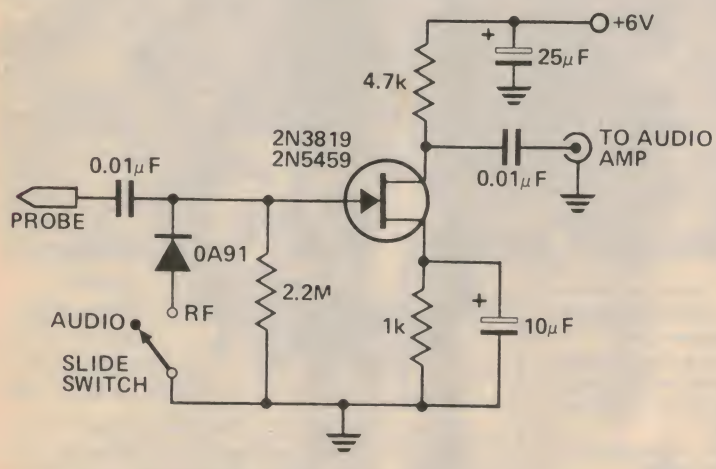
Ideas for experimenters

These pages are intended primarily as a source of ideas. As far as reasonably possible all material has been checked for feasibility, component availability etc, but the circuits have not necessarily been built and tested in our laboratory. Because of the nature of the information in this section we cannot enter into any correspondence about any of the circuits, nor can we produce constructional details.
Electronics Today is always seeking material for these pages. All published material is paid for — generally at a rate of $5 to $7 per item.

AUDIO-RF SIGNAL TRACER PRE-AMP

This economical signal tracer is very useful for servicing and alignment work in receivers and low power transmitters. It is easily constructed on a small piece of matrix board which can be mounted inside a commercially-available probe case or homemade probe. The slide switch can be mounted on the probe housing. A miniature toggle switch could be used as a substitute.

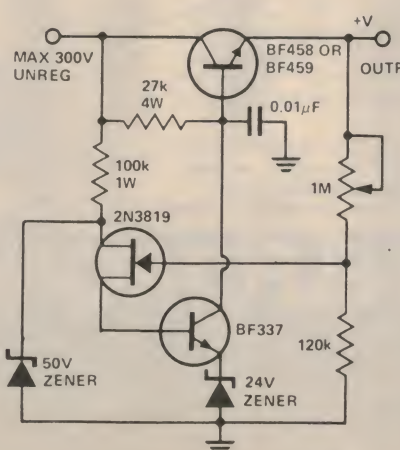
When switched to RF, the modulation on any signal is detected by the diode and amplified by the FET. A twin-core shielded lead can be used to connect it to an amplifier and to feed 6 volts to it.



VARIABLE, HIGH VOLTAGE REGULATOR

This regulator is ideal for SSB linear amplifier tube screens. It would also have application in the repeller supply for a reflex-klystron microwave oscillator. CRO deflection amplifier supply is another possible application.

Regulation is about 0.5%. The output transistor will need to be mounted on a small, insulated heatsink. A BF459 is preferred (30V Vceo) as the BF458 is sailing a bit close to the wind when the output is down to 50 V.



NOTE: 50 to 250V MAX OUTPUT CURRENT 25mA @ 50V 120mA @ 250V

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But it's not only a Radio Direction Finder! You can listen to the FM stations for relaxing, good music — or to the CB channels, or the walkie talkie, marine or fishing/boating club frequencies, or to the aircraft bands, amateur operators, taxis, etc etc. What a fantastic, versatile little receiver.
For the technically minded, this unit has 19 transistors, 12 diodes and has 3 separate RF front ends! There are also 2 separate IFs (10.7MHz & 455kHz) and the CB band has dual conversion. It operates off internal batteries (4 x 'C' cells) or off external 6 volt power. It has controls for RF gain, tone and AFC as well as the usual volume and band switches This unit is designed and built in Japan to Australian specifications (not some back-yard operation in Hong Kong as many 'rubbishy' units).
Don't be fooled by other units you may see around — this has been designed 'from the ground up' as a radio direction finder. It is in no way an 'adapted' portable receiver. The extra bands were added to the DF as extra value.

HANS THOLSTRUP USED THE R.D.F. TO CROSS BASS & TORRES STRAIGHTS.

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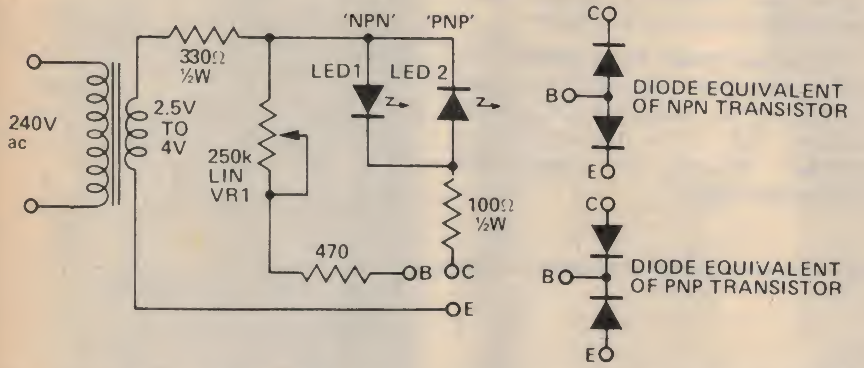
Ideas for experimenters

GO/NO-GO DIODE/TRANSISTOR CHECKER



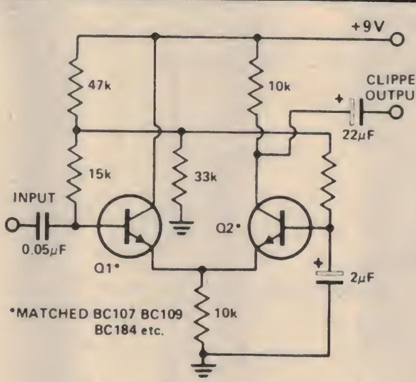
A diode can be checked by connecting it between C and E. If LED 1 lights the diode is OK and its anode is connected to C. If LED 2 lights its cathode is connected to C. If both light it is a short circuit suitable only as a link!

To check transistors with known pin connections, set VR1 at maximum resistance and connect the transistor. Advance VR1 until one LED lights. If LED 1 lights it is NPN, PNP if LED 2 lights. If both light you have a three-legged link. If neither light you have a three-legged fuse!

To check transistor connections, if unknown, short two of its leads together and check as for a diode making note of which lead/leads respond as anodes. Short two other leads together and do it again. Refer to diagrams above.

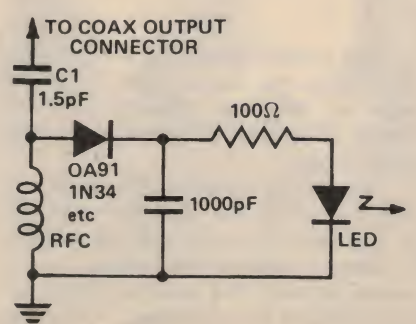
PRECISE AUDIO CLIPPER

A differential amplifier makes an excellent audio clipper and can provide precise, symmetrical clipping. The circuit shown commences clipping at an input of 100 mV. The output commences clipping at ±3 V. Matching Q7 and Q2 is necessary for good symmetrical clipping, however, if some asymmetry can be tolerated this need not be done.



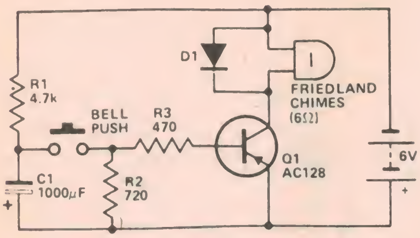
LED RF INDICATOR

An RF output indicator using a LED is very useful for monitoring the output of a transmitter. This circuit will give indication from a 5 W transmitter. The capacitor C1 and the RFC are chosen for the appropriate frequency. The RFC could be replaced by a resistor for wideband use. The sensitivity depends on the value of C1 and the resistor used if the RFC is replaced. For high power transmitters, C1 could be a small 'gimmick" capacitor.



Ideas for experimenters

DOORCHIMES DELAY



Ever get tired of people who repeatedly press your doorbell?

With values shown, this simple circuit will permit one operation every 10 seconds or so. Capacitor C1 charges through R1 when the button is released. Making R1 larger will increase the delay.

FLICKER-FREE FLUORESCENT STARTING

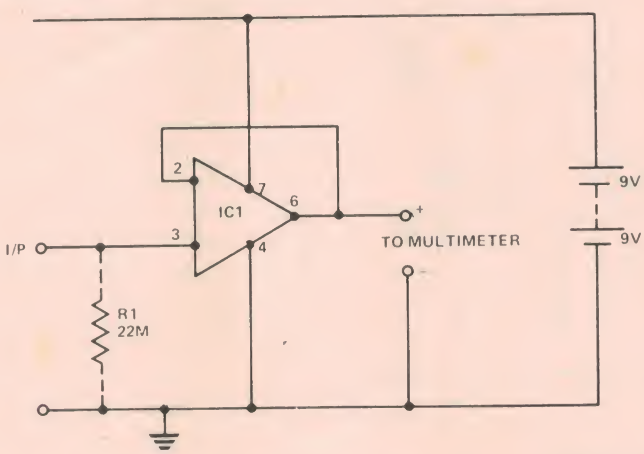
Here is an extremely simple, yet effective modification which will eliminate the annoying flickering when a fluorescent lamp is first switched on.

The modification consists of inserting a diode (P.I.V. about 600 V) in series with the starter. This results in a fairly heavy current on initial switch-on, which heats the filaments quickly. When the starter contacts open again, the lamp fires immediately.

NOTE: The effectiveness of the modification, depends largely upon the characteristics of the starter; try and find one that is quick-acting.

My original unit has been working successfully in my desk lamp for the past three years, and I've had no problems with dc magnetisation of the ballast, or excessive power consumption on switch-on.

100,000MΩ DC PROBE?



Most multimeters used for transistor work have an input impedance of 20,000Ω/V.

Occasionally, especially when measuring potentials on high impedance equipment, this sensitivity is sufficient. The circuit shown, however, presents neglible loading on the circuit under test.

A 741 op amp is used with 100% AC and DC feedback to provide a typical input impedance of $10^{11}\Omega$ and unity gain *(or so the contributor claims, Ed.).*

Due to the possibility of hum and RF pickup the input leads should be kept as short as possible and the circuit should be mounted in a small *earthed* case.

The output leads may be as long as required since the output impedance of the circuit is a fraction of an ohm.

With no input the output level is indeterminate. This state of affairs can be changed by including R1 in the circuit, though this lowers the input impedance.

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22uF	7c	8c	9c	11c
33uF	8c	9c	10c	13c
47uF	9c	10c	11c	14c
100uF	11c	12c	13c	17c
220uF	13c	17c	15c	20c
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Chart to identify all leads plus triggering details — 15c

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Please Explain

Phaser

I find my phaser works better on six 1½ V batteries than it does on a single 9 V type. Also I have found that when used with a guitar the signal to noise ratio is poor. Is there anything wrong with my unit?

J.B., Sydney

The lower the source impedance of the 9 V supply the better the operation. One suggested method is to use a 12 V battery and a 78L09 regulator.

The phaser is designed for a maximum input of one volt. The trouble with a guitar is the big variation in output voltage between various makes and the huge dynamic range of each individual instrument. One way to improve the signal to noise ratio is to pluck the strings harder. It may be necessary to boost the signal before feeding it into the phaser — if you are getting less than 100 mV then use a preamplifier to bring this up to 800 mV — 1 V.

Compressor-Expander

I recently completed your Audio Compressor-Expander project, and after using it for a while I noticed a problem: If a drummer is beating softly on the hi-hat and periodically beating the bass drum, the level of the hi-hat increases when the drum is struck. The same effect is apparent when using a dbx unit.

Is it possible to make the Compressor-Expander frequency selective to overcome this problem?

C.M., Fairlight, NSW.

There are two ways to make a Compressor-Expander frequency-selective. You could contrive to operate the unit on a particular band of frequencies -- so the input signal goes to a crossover unit and certain frequencies then goes through the unit and into a mixer where they recombine with the rest of the spectrum. The other way is to compress (or expand) the whole audio spectrum - but under the control not of the whole spectrum (as in the original unit) but of selected frequencies. So, in the situation you describe, the frequency of the bass drum could be filtered out from the control circuitry so it has no effect on compression.

Somewhere in the control circuit we have to place a filter to stop unwanted frequencies from controlling the gain of unit. A series-resonant coil and capacitor in the control loop will short these frequencies to earth as in Figure 1. The response of this filter is notch-shaped. At the rejection frequency $X_L = X_C$ = approx 500 ohms. This would give a Q of two — the 3dB band would be 150 Hz wide at 300 Hz, 500 Hz wide at 1kHz, etc. If L and C are chosen so $X_L = X_C$ = approx 100 ohms, the Q of the filter will be 10 — 3 dB band 30 Hz wide at 300 Hz, 100 Hz wide at 1 kHz.

If it is required that the filter should pass frequencies above a certain figure and reject all below it, a capacitor can be inserted (in series) in the control circuit. Should a low-pass (high frequencies rejected) filter be desired then the capacitor should connect down to earth see Figure 2(b). The capacitor should be selected so that $X_C = R$ at the crossover frequency (3dB down).

The reactance of the coil or capacitor at any frequency can be calculated from the formulae:

$$X_C = \frac{1}{2\pi fC} \quad \text{and} \quad X_L = 2\pi fL$$

Inductors for use at audio frequencies can be constructed in the same manner as those used in the ETI Graphic Equaliser.

The place to insert the filter in the Compressor-Expander is in place of C3 and C4, provided the filter offers dc isolation between the two stages (ie, if there is a capacitor in series with the signal). If the filter does not isolate the stages then leave C3 and C4 in circuit.

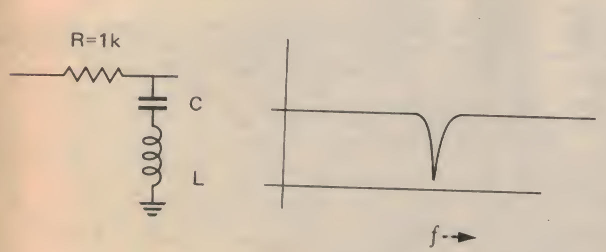

Fig. 1. A notch filter. The values of L and C are chosen so that $X_L = X_C = R/Q$ at the rejection frequency. So, for a Q of 2 at 150 Hz, $X_C = 500\Omega$, $\therefore C = 2\mu F$, and $X_L = 500\Omega$, so L = 530 mH.

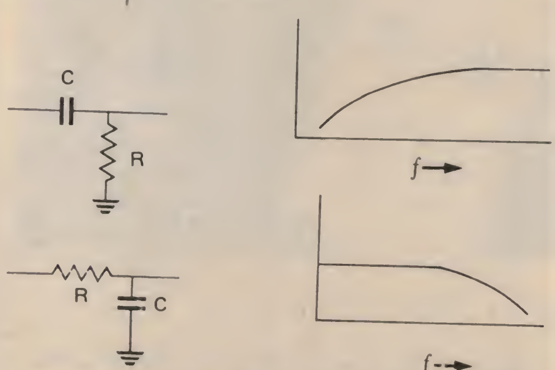

Fig. 2. Simple low-pass and high-pass filters. The signal will be 3 dB down at the frequency where $X_C = R$.

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CB AUSTRALIA

Long on guts, short on distortion.

CS-911A

No weaklings here. Pioneer's improved CS Eleven-A series speaker systems are built tough to stand up to high power inputs all day long and come back for more 'til the dawn's early light.

Today's modern recording techniques capture a wider dynamic range than ever before possible. In comparison, your other components merely pick up the sound, channel it through and pump it out. But, it's the speaker system that must bear the brunt of this electronic onslaught. The CS Eleven-A series solves this problem with exciting new innovations in speaker technology.

In the big, full size woofers, a carbon-fiber blended cone. Highly elastic, yet incredibly strong, this material reduces power loss and eliminates audible distortion. With high efficiency like this, what goes in sounding natural, comes out that way. In other words, better bass for your bucks.

Crossover to the higher range units is smooth and accurate. In addition, front mounted level controls compensate for deficiencies in individual room characteristics. After that, a removable grille of acoustically transparent foam. Exhaustively tested, this material was proven to give no attenuation at any frequency over the full listening spectrum.

There are four outstanding systems in the CS Eleven-A series. Such a wide range gives you room to match your other components, listening area, and of course, your budget.

Pioneer's improved CS Eleven-A series. Great sound because they're built tough. Soft on your bankroll because they're priced right.

	Maximum input power	Enclosure type	Speaker units (Type)			Frequency range
			Woofer	Mid-range	Tweeter	
CS-911A	150W	Bass reflex bookshelf	15 inch cone (38cm)	4 inch cone x 2 (10cm)	3 inch cone (7.7cm) 2-1/4 inch cone x 2 (5.7cm) (Supertweeter)	25 – 22,000Hz
CS-811A	120W	Bass reflex bookshelf	12 inch cone (30cm)	4 inch cone x 2 (10cm)	3 inch cone (7.7cm) 2-1/4 inch cone (5.7cm) (Supertweeter)	30 – 22,000Hz
CS-711A	100W	Bass reflex bookshelf	12 inch cone (30cm)	4-3/4 inch cone (12cm)	2-5/8 inch cone (6.6cm)	30 – 20,000Hz
CS-511A	70W	Bass reflex bookshelf	10 inch cone (25cm)	3 inch cone (7.7cm)		35 – 20,000Hz

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PIONEER®
leads the world in sound.